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ELECTRIC LIGHTING FOR RAILWAY CARRIAGES.

THIS is a subject which is now attracting considerable attention amongst the directors and officials of some of our leading railway companies. That something more efficacious than the oil lamps we have to content ourselves with on the majority of railroads, is desirable, is admitted, and many attempts have been, and are still being, made to increase our comfort in this respect. Gas has been in some cases successfully introduced, and electric lighting is now spoken of as being likely to come to the fore. Our readers are well aware that many schemes have been brought forward for this purpose, notably the system of Faure accumulators, for some time used on the London and Brighton "Pullman" car. The weight, and the care required in the use of these apparatus, combined with the uncertainty of their action and life, has hitherto militated largely against their permanent adoption.

Primary batteries have been suggested and tried with a certain degree of success, and now a well-known electric lighting company has issued a circular to the effect that a system of lighting trains by electricity, which utilises and stores up the energy of the train in *down grades*, is expected to completely solve this problem. The circular we mention will be found in our other pages, and from what we there gather, we can only assume that a dynamo-electric machine in combination with secondary batteries will be employed. Returning for a moment to the methods at present in use for lighting railway carriages, we see that in the case of oil lamps each carriage is independent of its neighbour. We believe we are also correct in stating that on the Metropolitan Railway, where gas is the illuminating agent, the individual cars carry their own supply. The same arrangement has been, and will probably still be carried out in the case of primary batteries.

There is, then, in all these methods of lighting, an extreme simplicity. It appears to us absolutely essential that any electrical scheme, now or hereafter to be devised, should be of the simplest nature when applied to our railways. Anything of a complicated character should be avoided, and each carriage might advantageously be kept independent of its fellows. We are anxious, therefore, to know further particulars concerning the system which "*relies solely upon the utilization of the movement of the train*, and, by a means of storage of this energy the lights will continue to burn during any stoppage which may occur." Is it necessary that the train should be running at a certain speed and for a given time to produce the energy required? Does a train start from its destination, at any time, and at any place, with sufficient stored electrical energy to keep the lamps alight? Is the system of any use on lines where the gradients are not heavy? What would be the effect on the homeward run of a train, the outward run of which had been principally down hill? Is any provision made for the connecting and disconnecting of carriages during the journey? These, and many other questions must be satisfactorily answered before the problem of the electric lighting of railway carriages by the method here proposed can be said to be completely solved. We suppose that such matters have already been considered, although the circular to which we have referred gives us no information on these points.

Many persons may be cynical enough to assert that such circulars are issued for the purpose of keeping turbulent shareholders quiet, or as a set-off against some experiments recently made with primary batteries, but whatever may be the motive of the company in issuing its statement, it needs no further comment here. We are glad to see that some stir is being made in the direction of lighting railway carriages by means of electricity, and whether it be by dynamo-electric machines or by primary or secondary batteries that this is attained we shall be pleased to record a successful installation. Our railway directors generally, and on the lines north and west of the metropolis particularly, are sufficiently alive to their own interests, and we are feign to believe that they would heartily support a good and economical system of electric lighting for the benefit of their passengers, and hence for the advantage of their company.

THE INFLUENCE OF MAGNETISM UPON THE ELECTROLYTIC BEHAVIOUR OF METALS.

By H. VON JUEPTNER.

SINCE Berzelius proposed his electro-chemical theory, it has been held that the precipitation of one metal from its solutions by another is a process similar to electrolysis, or, in other words, that electrical forces come here into play. That the action of these forces might be modified by the action of other forces was *a priori* likely, but it is only of late that Ira Remsen has succeeded in giving an experimental demonstration of such action, at least as far as magnetism is concerned.

If magnetism exerts an influence upon the above-mentioned reaction, it can show itself either uniformly by a change in the intensity of the reaction through the entire mass, or non-uniformly modifying the intensity more in some parts than in others. In the latter case a chemical polarity would appear. If we, *e.g.*, introduce into dilute hydrochloric acid a piece of non-magnetic iron and then a magnetic piece, in the former case one of the two pieces of iron would be more attacked than the other. In the other case certain parts of the magnetic iron would be more attacked than others, which would be easily discovered on observation.

Unfortunately, M. Remsen was not able to obtain any iron sufficiently homogeneous, and could therefore not furnish the demonstration in the manner described. Indeed, the examination of the first-mentioned case had to be abandoned, as very complicated experimental conditions come into consideration, and it is therefore very difficult to draw precise conclusions, the more as the differences to be observed must be very trifling.

He was, therefore, obliged to try another method and by this he attained his object. He filled a flat vessel of thin sheet iron with a solution of sulphate of copper, and placed it upon the poles of a permanent Jamin magnet, able to support 25 kilos. In the course of from 1 to 2 minutes he could plainly distinguish through the liquid those parts of the bottom of the vessel which were in contact with the poles of the magnet. If the liquid was then poured off, the bottom of the vessel was found coated with copper, with the exception of

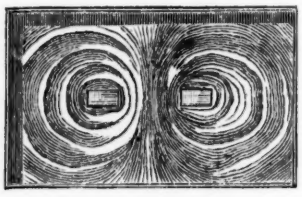


FIG. 1.

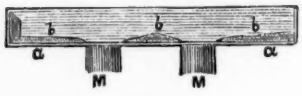


FIG. 1*a*.

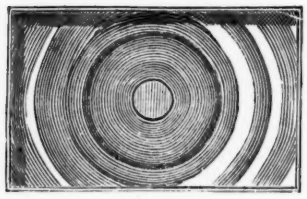


FIG. 2.

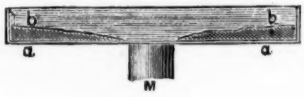


FIG. 2*a*.

certain lines, which represented the outlines of the magnetic poles. These lines appeared as sharply-marked depressions in the coating, and proved that the intensity of the reaction was decreased in these parts. In addition there appeared less regular lines, produced by unequal depositions of the copper. They were most distinct between the two poles, extended around them, and coincided with the lines of equal magnetic intensity, as shown in fig. 1.

A repetition of the experiment with a smaller magnet, and also with a larger electro-magnet, led to the same result.

Finally, the latter magnet was applied in such a manner that the line connecting both poles was perpendicular, and therefore only one pole came in contact with the iron vessel. In this case also (fig. 2) there was no deposition of copper at those points which came in immediate contact with the magnetic pole, whilst the less-distinctly defined lines above-mentioned formed concentric circles, separating from each other, surfaces of unequal deposition of copper, and which could be traced as far as five centimetres from the pole. To show more distinctly the manner in which the copper is deposited, we give in figs. 1*a* and 2*a* sketches of sections through the pole. *a* is the iron bottom of the vessel, *b*, the deposit, and M, the poles of the magnet. To make the illustration more distinct, the thickness of the deposit is exaggerated. It is seen in the figure that the layers at greater distances from the magnetic pole are wider apart from each other and increase less in thickness.

The explanation of the phenomenon is very simple. The attraction exerted by the magnet upon the iron of the vessel counteracts its solution, and consequently the deposition of the copper. The quantity of copper deposited is, therefore, approximately inversely as the magnetic force. Immediately at the magnetic pole the magnetic attraction, in the above-mentioned experiments, overcame the chemical (electrolytic) forces; no copper was deposited as no iron was dissolved. The greater the distance from the magnetic pole, the feebler is the magnetic force, the more iron is dissolved, and the more copper deposited.

If the experiment is repeated with a magnet supporting only ¼ kilo., and with a strongly diluted solution of the sulphate or chloride of copper, the magnetic attraction no longer suffices to protect the iron even immediately at the poles, and an approximately uniform deposit of copper is obtained.

Very interesting results would be obtained by repeating these experiments with magnets of different strengths and with solutions of copper of different concentration.

If a vessel of zinc is set upon the poles of a magnet instead of an iron vessel, and filled with a solution of iron, an inverse phenomenon should occur.

At the poles, where the magnetic attraction is strongest, the greatest deposition of iron must take place, and the coating will become thinner the greater the distance from the poles.—*Zeitschrift des Elektrotechn, Vereines in Wien.*

ON THE ELECTRICAL RESISTANCE OF THE HUMAN BODY.

Nature publishes an abstract of a paper read before the British Association at Southport, by W. H Stone, M.A., F.R.C.P., in which the writer, after premising that hitherto electricity in its application to the human body had not come up to expectations reasonable in the case of so powerful a force, and that it was evidently still in an embryonic state, mentioned some examples of the conflicting and contradictory statements made by different authorities as to its electrical resistance. These varied from 13,000 to 2,875 ohms and less. He believed it was enormously overstated, and had for this reason applied himself to make some more accurate determinations. He was at once met by three obstacles :—(1) The difficulty of making good contact through the skin of a living man. (2) The limitation of the amount of current by pain, and by the fact that the rapid opening and closing of strong circuits produced a tetanic state of muscle. (3) The fact that the human body is an easy electrolyte, almost immediately furnishing currents of polarisation.

As regards (1), the axiomatic statement seemed to be that the poles must be infinitely large compared with the current they had to conduct. This condition he had attempted to fulfil in five different ways, two at least of which were successful: either by immersing the feet and hands in baths of brine in contact with an electrode of amalgamated lead or zinc of from fifty to a hundred square inches surface, or by soaking these extremities in brine, and then wrapping a strip of flexible lead two feet long by two inches wide about them, after the fashion of a surgical spiral bandage. The fact that the skin resistance was thus reduced to zero was proved to demonstration by an observation, from which it appeared that the resistance of a corpse, treated with the spiral leaden bandages from foot to foot was 1,150 ohms, and with solid silver conductors thrust three inches deep into the plantar muscles was actually 50 ohms more.

Under the heading of contacts it was essential to determine definite anatomical points from which the measurements should start, and which readily admitted of linear verification. Such points existed in the prominence of the ulna at the inner side of the wrist, and the lower edge of the external malleolus at the ankle. The shortest course traversed by the current

between these two points had been measured to a quarter of an inch.

There were three principal directions in which determinations had been made :—

1. From hand to hand.
2. From foot to foot.
3. From hand to foot.

No. 1 was much the same as the height of the subject, and was not liable to great variation.

No. 2 varied more, since the difference between very tall and shorter men lies chiefly in the legs.

No. 3 was perhaps the best test of the average conductivity of the body, since looped currents were sure to traverse the whole trunk, and even caused motor disturbance in the extremities not included in the circuit.

Three such observations were given, including one on a man of the exceptional height of nearly 8 feet.

As regards pain, it was noted that the E.M.F. used varied from three to ten bichromate cells of 1·8 volts each. Even the first was occasionally complained of, thus incidentally showing the goodness of the contact obtained. In morbid conditions, such as that termed myxœdema, the E.M.F of 10 cells or 18 volts through a resistance of only 1,260 ohms was easily borne, and indeed hardly felt. The third difficulty, that namely of electrolysis, was the most serious : indeed the particular metal of which the electrodes were made sank into insignificance compared with the rapid and vigorous polarisation of the moist tissues of the body itself. A rotating commutator on Wheatstone's plan, and afterwards a metronomic instrument, by which the periods of alternation could be varied, were first used, but with only partial success. A more delicate mode of discharging was found in the use of an ordinary commutator key worked like a piano with the index and middle fingers of the left hand ; a double contact key, putting battery and galvanometer successively in circuit, being beneath the right index finger. The left keys being first depressed alternately, the right key produced a double deflection, while the bridge resistance was too low, which was replaced by an opposite double deflection when it was intentionally made too high. By watching the galvanometer a point was easily found where it ceased to "throw," and then three successive contacts in either direction were taken to determine resistance. In spite of all precautions, the second measurement was sometimes in excess of the first, owing to a polarisation-current assisting the battery. This, however, never amounted to more than about five ohms, and was easily allowed for. Between each set of observations a short-circuit key, inserted outside the bridge, was closed for at least a minute, so as to discharge patient, bath, and electrodes.

The measurement was then repeated with inverted current, and the mean taken.

One set of examples out of many was read to the meeting. Three men of very different heights were tested according to the following table :—

	Height.	Weight.	Ulna to malleolus.	Foot to foot.	Foot to hand.
	ft. in.	st. lb.	ft. in.		
1. Mr. Todd	5 6 ...	7 13 ...	5 9¼ ...	945 ...	1,320
2. Mr. Shackel	6 3 ...	13 0 ...	7 0 ...	930 ...	1,027
3. Hungarian Giant ...	7 8 ...		... 8 7 ...	930 ...	1,032·5

Two of these were students at St. Thomas's Hospital ; the third an Austrian now exhibiting at the Aquarium, and kindly lent to the writer for examination. All the three were singularly strong, healthy, well-proportioned men, of active athletic habits. An interesting illustration of physiological laws here incidentally cropped out, showing that, in the normal human body considered as a machine, as is the length of the osseous levers so is the sectional area of the motor muscles. This in the present instance results in an almost complete identity of the electrical resistance, increased length being very fairly balanced by increased sectional area in the conductor. A good test of morbid leanness or fatness might probably be founded on this identity.

A few words only were given to the variations of human resistance in disease and with alteration of temperature.

As regards the former, six cases of hemiplegia were cited : three on the right and three on the left side of the body, in all of which the paralysed was found less resistant than the healthy side, in amounts varying from 120 to 730 ohms. The only case which differed from this rule was that of a worker in copper, from whose secretions three milligrammes of metallic copper had been extracted, where the cupreous impregnation obviously modified the general resistance of the body, as the writer had found it to do in the case of lead and mercury also.

A confirmation of the view already expressed by the writer of the paper, that the human body follows the law of solid rather than that of fluid conductors under changes of temperature, had occurred in the instance first quoted, where the occurrence of dropsical effusion in the lower extremities permanently reduced the resistance from the values originally given, the lowest of which was 2,300, to 750 ohms.

REPORT ON SECONDARY BATTERIES.

(*Report presented by* MM. D. MONNIER *and* E. GUITTON *to the syndicate of "La Métropolitaine Electrique," on the application of Faure-Sellon-Volckmar accumulators to incandescence electric lighting and to the propulsion of tramcars.*)

1. THE RENDERING OF THE ACCUMULATORS.

Accumulators store up, by chemical action, the electrical energy furnished to them by an external source, and then reproduce this energy in the form of an electrical current by virtue of chemical reaction.

This double transformation cannot be realised without a loss of work which it is desirable to estimate as accurately as possible.

The rendering of accumulators is the relation between the quantity of electrical energy furnished to the accumulator and the work which it will furnish in discharging.

This co-efficient has been determined experimentally with a battery of 10 elements of accumulators of the type 17·5 k., which were sent to us charged.

The battery was discharged, then recharged and discharged four times alternately.

The four charges furnished 1,761,816 coulombs of electricity, with a total energy of 4,040,000 kilogrammètres.

The four corresponding discharges furnished 1,485,966 coulombs of electricity, with a total energy of 2,526,630 kilogrammètres.

The final discharge being stopped at the moment when the battery was in the same electrical condition as at the commencement of the first charge, the sum of the results furnished by the four successive discharges represents the actual rendering of the four corresponding charges.

The preceding figures show therefore :—

1. That the total quantity of electricity returned in discharging is equal to 84·34 per cent. of that which was consumed for charging ; this is the *rendering in quantity*.

2. That the total amount of energy given off in discharging is equal to 62·44 per cent. of that which was consumed for charging ; this is the *rendering in work*, the most important from a practical point of view.

2. THE CAPACITY OF ACCUMULATORS.

The capacity of an accumulator is measured by the total work which it will furnish after having been completely charged ; but, practically, accumulators are never completely discharged, because the last few hours of a complete discharge only furnish a very

small quantity of energy which it would be difficult to utilise. Besides, the energy which the accumulator still possesses is not lost; it constitutes a permanent reserve necessary for the regular working of the apparatus.

The practical capacity of an accumulator will therefore be lower than its actual capacity; it will be measured by the work which the accumulator will furnish usefully in continuous operation before being re-charged. It is thus that we found that our battery of 10 elements, containing 175 kilogrammes of useful material, would furnish in continuous operation a total work of 670,752 kilogrammètres, or 2·4843 H.P.-hour, which corresponds with 14·2 H.P.-hour per ton of useful material, or 70 kilogrammes per H.P.-hour.

The battery gave an average of 14·76 ampères, or 0·84 ampères per kilogramme of useful material in one of the series.

The capacity deduced from the preceding data is not absolute, and it is probable that, by improvements in the construction of the accumulators, the weight of metal required per horse-power hour will be considerably reduced.

The figure given above applies to continuous working, as, for instance, for lighting exclusively by a battery of accumulators; if the work was not continuous, or if the accumulators were employed merely as a regulator upon a circuit supplied by a dynamo, the practical capacity would be greater.

We would remark that, in most cases, the weight of the accumulators employed is intentionally increased rather than diminished, for if, on one hand, it entails an increase of the capital invested, on the other the apparatus will wear better.

The figure given above should, therefore, be considered as a simple indication referring to a special case, and it is industrial experiment which must determine, for each kind of application, the most advantageous relation between the weight of the accumulator and the work to be done.

3. THE DURABILITY OF ACCUMULATORS.

It is evident that the durability of accumulators depends on the quantity of energy which they have to store up. Experimental data on this important point is wanting, but we think that it is possible to estimate accurately enough the maximum limit of use of accumulators.

It would be out of the question to begin here a detailed discussion of the various chemical reactions which take place in an accumulator during the period of charge and discharge, and we will confine ourselves to mentioning that the gradual alteration in the accumulator is due to parasitic reactions which absorb, as pure loss, a portion of the work supplied, and transform the positive electrode by degrees into bioxide of lead, so that in time the positive plates become inert, and must be replaced whilst the negative electrode is not sensibly changed.

To transform by electrolysis 1 kilogramme of lead into bioxide of lead, it requires 1,855,000 coulombs of electricity.

To transform in the same manner 1 kilogramme of minium it requires 565,600 coulombs of electricity.

The plates of the positive electrode are formed of 2 parts of lead, 1 part of minium.

Therefore, in order to completely peroxidise 1 kilogramme of positive electrode, it would require 1,425,200 coulombs of electricity.

Adopting the rendering in quantity already found (84·34 per cent.), and admitting that the quantity of electricity lost in the discharge is entirely consumed in oxidising the positive electrode, we see that when the accumulator has received 9,100,000 coulombs of electricity, 1 kilogramme of positive electrode will have been rendered useless. The work furnished by the accumulator during this time will have been 4·5 H.P. hours.

But experiment shows that the loss of electricity is caused partly because the gases resulting from the electrolysis are not completely fixed by the electrodes; the consumption of the positive electrode will be, therefore, in reality, slower than the preceding calculation indicates. As this electrode would be rendered useless before the peroxidation was complete, we will admit that, in practice, the positive electrode will act as if the consumption was 250 grammes of useful material per H.P. hour disposable from the accumulators.

4.—MOTIVE POWER REQUIRED FOR CHARGING ACCUMULATORS.

Accumulators are charged by means of shunt-dynamos, of which the dimensions and winding should be suitable for this special work. With a Siemens S D_0 machine meeting these requirements, we obtain at the terminals of the machine 85 per cent. of the total electrical work.

This total electrical work being itself 0·88 of the motive power developed, we see that the electric energy disposable at the terminals of the dynamo represents 74·80 of the motive power.

The accumulators having, as we have already shown, a rendering in electrical work of 62·44 per cent., their mechanical rendering will be 46·5 per cent.—that is to say, that 1,000 kilogrammètres of work developed by the motor would be equivalent to 465 kilogrammètres disposable from the accumulators.

(To be continued.)

D'ARLINCOURT'S ELECTRO-MAGNET.

THE action of this electro-magnet is based on the natural inversion (produced by the breaking of a current) in the part of the electro-magnet situated in rear of the bobbins, that is to say, at the breech end. An armature or pallet polarised by one of the poles of a permanent magnet and placed between the secondary poles existing beneath the bobbins of the electro-magnet will therefore be attracted by one of the secondary poles during the passage of the line current; on the breaking of this current the magnetism of the electro-magnet becomes reversed and the pallet is forcibly repelled towards the other secondary pole.

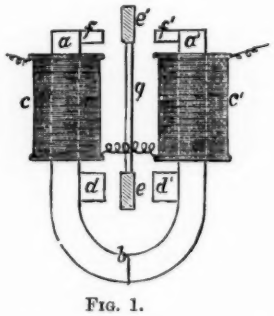


FIG. 1.

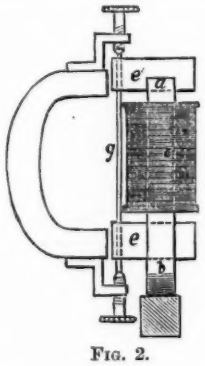


FIG. 2.

This arrangement of an electro-magnet, which is susceptible of application to all electrical apparatus but principally to a telegraphic relay, thus comprises a single pallet actuated by the secondary poles of the electro-magnet. The modification which M. D'Arlincourt has made in this well-known invention of his, consists in providing the apparatus with a second pallet placed at the free extremity of the bobbins and fixed on the same axis as the first pallet situated at the rear or breech end of the electro-magnet, this second pallet being magnetised by the other pole of the permanent magnet. The two pallets are thus rigidly connected and are of opposite polarities, and their simultaneous operation can only occur upon the condition that the polar pieces between which one of the pallets plays have opposite polarities to those of the polar pieces between which the other pallet plays. But in order that the magnetic effects shall be opposite in the two pairs of polar pieces by

which the combined armatures are actuated, it is necessary that the electro-magnet be traversed by a certain electromotive force. In the case of a weak current the polarity in one of the polar pieces at the rear or breech end is of the same name as that at the extremity of the same branch of the soft iron core. Consequently, such a current cannot cause any mechanical action of the axis of the combined armatures, which in this case is influenced by a couple of forces which are equal and opposite.

Fig. 1 is a front view and fig. 2 a side view of the electro-magnet; a, a^1 is the core of the electro-magnet; b the breech end of the same; c, c^1 the bobbins traversed by the line or other current; d, d^1 secondary poles acting on the pallet, e; f, f^1 soft iron pole pieces acting on the pallet, e^1; g an axis common to the two pallets, e, e^1.

THE REIS TRANSMITTER.

THE world has an interest in knowing what relation Philipp Reis, of Germany, has to the speaking telephone of to-day, what he did is of great importance to us, says a writer, signing himself W.X., in the New York *Electrician*, because if he invented an electric speaking telephone twenty years ago, and made the invention known not only by descriptions of the device, but by making and selling his telephones in public market, it is clear that the credit for the invention belongs by right to him, and it is also plain that so much as he invented belongs now to the world, and ought not to be the exclusive property of any man or company of men.

On this question, as to what Reis did, there has been a vast deal of talk in courts, and a great deal of craftiness by lawyers has been displayed, and the language has been so carefully shaped for the requirements, that if the language were like a machine it would no longer be fitted for ethical purposes. Let us see then what it was that Reis *did*.

1st. *He invented a certain device which he called the telephone.* It consisted of two parts, a transmitter and a receiver. Some of his constructions are in existence to-day just as he used them and left them. Let us examine the structure of his transmitters. He made 8 or 10 varieties, but they all involved the same idea. For the purpose, we will take the bored-block form such as he exhibited to the Physical Society at Frankfort-on-the-Main, 1861.

Now here is a device, a collocation of mechanical details invented and constructed for a specific purpose; namely, the variation of an electric current by means of sound vibrations, chiefly those of the voice, as the tube plainly shows. Is it adapted to its purpose, and will it do the work for which it was designed? This is a question which may be answered in two ways, theoretically and experimentally. If the above instrument, or a fac-simile of it, be connected properly with a magneto receiver, its capabilities may be experimentally tested, and when thus tested, it is found to be a good speech transmitter, extremely sensitive as a microphone, and words spoken ten feet from it may be plainly heard at the receiver. If that be true, it follows that the Reis transmitter, just as he left it, is capable through its appropriate action of giving to the electric current its proper variations for the reproduction of speech, in other words, it yields the genuine undulatory current. What is true of this transmitter is true of the more common form of Reis transmitter: namely, the cubical box with the membrane on the top. Especially good will the results be, if the transmitter be coupled in the primary circuit of a small induction coil, while the receiver is in the secondary circuit.

Reis invented these transmitters for this purpose, and he used them for the same purposes, and he said he heard words at the receiver which were spoken at his transmitter, and what he said was corroborated by quite a number of his contemporaries, several of whom are now living, but as an offset to the above it has been affirmed, and the courts have so ruled, that Reis *intended* that his transmitter should work in such a way as to make it impossible that speech could be transmitted by it; namely, he *intended* that the electric circuit should be broken for every vibration, and the evidence for it is his description of the working of his device. This declaration is equivalent to the assertion that what Reis invented was—not certain instruments for a certain purpose, but—*a theory of the working of certain pieces of apparatus;* and consequently, if Reis did not describe* the working of his devices correctly, he did not invent the devices, and consequently, the world has no right to his apparatus.

Again let us inquire what it was that Reis invented. Suppose that in place of the platinum terminals he had used iron, or copper, or carbon, or anything else, would it have changed the character of the device? Not at all. One might have answered better than another for the purpose, but all would act in substantially the same way, the differences would be altogether those of degrees and nothing else. Let a piece of electric-arc light carbon be substituted for the platinum in either of the forms of Reis's transmitters, and at once it becomes equal to the very best of modern transmitters. Why? Because the *intention* has been changed? No. Because the mechanical arrangements have been modified? No. Indeed, it is only because of the demand for a superior article of carbon for electric lighting that such carbon for transmitters has been adopted, as any one may verify for himself by trying any ten-year-old carbon stick in his transmitter. Has the one who substitutes the carbon for the platinum invented the *undulatory current?* It is preposterous. At best he has made the transmitter more useful, but, even in that place the function of the carbon is simply to vary resistance, and it had been put to that service years before.

2nd. *Reis described his apparatus and gave his theory of its action.* This is the part that is seized upon by the assailants of the claims of Reis as being the inventor of the speaking telephone. Suppose, for argument sake, it be admitted that Reis expected to reproduce speech by means of an intermittent current, and that he *intended* that his transmitter should make and break circuit for every vibration. It must be admitted that any automatically working device can only work in accordance with the mechanical conditions present in the device, and no will, or intention, or theory concerning it will make any difference in its working, so long as it is not otherwise *compelled* to work differently, in which case it would not be automatic. What then does it matter how Reis thought his machine acted? His *theory* of its working might have been wholly wrong, yet its performance be wholly right. When *we* speak to a Reis transmitter we find it gives the proper undulatory current for the transmission of speech. *It must have done so for Reis*, unless physical laws have changed since his time, and it is not likely that anyone will have the hardihood to affirm that; and it is only by trifling with the facts, and by ingeniously framing sentences, that conclusions hostile to Reis's claims have been drawn. How then does the case stand? Reis did two things. He invented a telephone transmitter for the purpose of the electric transmission of speech sounds and any other. He succeeded in doing it, and we can to-day with the same instruments. He also *described* his devices giving a theory of their action, which in some particulars is inexact. These two things he *did*. The courts have decided, that, because he did not *describe* the action of his device, as we would describe it to-day, when used for the same purpose it was invented for, that the Bell Company is, therefore, entitled to a monopoly of what he *invented* for the purposes for which he invented it.

The Duplex Electric Light, Power and Storage Company, Limited.—Mr. Samuel Lovelock, chartered accountant, 19, Coleman Street, E.C., has been appointed official liquidator of this company.

* Judge Lowell said in a recent case: "I decided in *American Bell Telephone Company* v. *Spencer*, that Reis had not *described* a telephone which anticipated Bell's invention."

NEW SYSTEM FOR SUBTERRANEAN CABLES.

MESSRS. DELUNE & CO. propose an arrangement, which they have patented, and which consists of tubes made with a cement core, the section of which is represented by the subjoined figs. 1 and 2, showing respectively the open and closed tube.

These tubes, which we find described in *L'Electricité*, have a longitudinal opening along the upper side; they are placed end to end and joined by a collar of cement. The cables are placed in position by simply uncoiling; the drawing in which they undergo in the case of cast iron tubes, and which, therefore, modifies their molecular condition, is thus avoided.

When the cables are laid, the longitudinal opening is closed with cement, and there is then a well-closed canal, the hardness of which increases with time. The value of this system depends, therefore, chiefly, as in all cement work, on good workmanship.

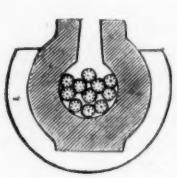


FIG. 1.

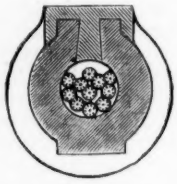


FIG. 2.

Trials have been made at Toulouse by the Ministère des Postes et des Télégraphes, and at Lyons by the Société Générale des Téléphones.

On this, as on all similar questions, we can only decide after a prolonged trial. But this does not prevent us from considering its primary advantages: firstly, an economy of about 50 per cent. over cast iron tubes, then better insulation, and consequently more efficacious protection of the circuit from all kinds of disturbances, since the neighbouring metallic mass is replaced by a mass of non-conductive cement.

Now that subterranean systems occupy so important a place in electrical industry generally, we shall follow with interest, says our contemporary, the progress of an invention so closely connected with them.

THE STEAM ENGINES AT THE FISHERIES EXHIBITION.

MANY of our readers, especially those residing in the country and abroad, have doubtless been debarred from inspecting the electric lighting systems so successfully employed for illuminating the vast spaces devoted to the recent Fisheries Exhibition. Some idea of the electrical exhibits may have been gleaned from our columns, and we now illustrate the compound engines of Messrs. Davey, Paxman & Co., of Colchester, which, together with several semi-fixed and portable engines supplied by the same firm, constituted the entire source of power for driving the dynamo-electric machines. It is scarcely necessary to mention, at least to those who have had opportunities of visiting the Exhibition, that, up to the present time, the electric lighting installation there shown is by far the largest and most important which has yet been seen in England. The work undertaken by the Colchester firm in providing the necessary steam-power for such a purpose is, therefore, not the least interesting or unimportant part of the exhibit.

The dynamos in the eastern part of the large electric light shed were driven by two steam-engines, one of which is a compound called the "Colchester." This engine is capable of giving off 250 indicated horse-power. The bed plate is of a new type, formed of girders, planed on their sides and upper surfaces. When bolted together they form a strong, neat, and compact foundation. The novelty consists in the manner in which this bed plate is built and fixed together.

The cylinders are air-jacketted—the makers preferring this to steam-jacketting—but steam may be used if desired. They are placed on the bed plate mentioned above, with a receiver which forms the slide jacket between them.

The sizes of the cylinders are respectively 15″ and 22½″ diameter, by 24″ stroke, the revolutions being 103 per minute.

The crank shaft is formed of one piece of steel, the dip being balanced in a novel, neat and effective manner by a disc partially solid; the solid part being placed opposite the dip; it is so arranged that driving wheels may be fixed on either side of the engine.

Another new feature in the construction of this engine is the application of "Paxman's" Patent Automatic Cut-off Valve Gear, which is acted upon and controlled entirely by the governors in such a manner that the exact quantity of steam required for doing the duty is admitted into the cylinder at each stroke, at nearly boiler pressure. By this means the steam is expanded about six times and the utmost possible duty obtained.

The governors also possess new features, and it is evident that they control very perfectly the speed of the engine.

Steam is supplied to it by two locomotive boilers working at 120 lbs. pressure.

This "Colchester" engine is assisted by one of the same firm's nominal 25 H.P. semi-fixed engines and boilers, the engine being placed under the boiler. It is worked by steam, at 75 lbs. pressure when required.

The western end of the electric light shed claimed the place of honour, as it contained the largest amount of power.

One of the steam-engines, called the "Paxman," is of the coupled type, *i.e.*, two distinct engines, connected by a main crank shaft about 10 feet long.

The bed plates are of precisely similar construction to that of the "Colchester" engine.

Both cylinders are fitted with "Paxman's" Patent Automatic Cut-off Valve Gear, controlled by one governor. The engine is provided with two fly wheels, each 12 feet in diameter, placed in the centre of the crank shaft. From this engine two leather chain belts, each 15 inches wide, are driven on to the pulley of the line of shafting.

Steam is supplied by three large locomotive type boilers working at 80 lbs. pressure; but if required, both the engine and the boilers are made to work at 100 lbs. steam, and at this pressure the engine will indicate upwards of 350 horse-power.

At the same end of the shed are two other engines of the semi-fixed type, each capable of indicating 125 horse-power; also a large portable engine, divested of its wheels. This latter engine is fitted with "Paxman's" Automatic Cut-off Gear and governors.

This is the largest display of steam-engines ever publicly exhibited at work by one firm, the total power exerted being not less than 1,000 horse-power.

An approximate idea may be formed of the magnitude of the work done, when we say that not less than 40 tons of coal are required per week, and notwithstanding the fact that all the engines employed are of exceptionally economical types and specially designed to get the largest possible amount of power from the smallest possible quantity of coal.

Those who are familiar with the performance of steam-engines, will see that this is equivalent to a consumption of less than 3 lbs. of coal per horse-power per hour, and it must not be forgotten that the engines were worked under unfavourable circumstances, steam having to be got up every night, while the engines at the beginning of their duty were run for not more than three or four hours; as the days got shorter, however, the engines were run for a longer period, and the consumption of coal per horse-power per hour was reduced.

It is further to be noted that all these engines run with remarkable steadiness, uniform velocity of rotation of the driving power being so essential to successful electric lighting, and this has been secured in an

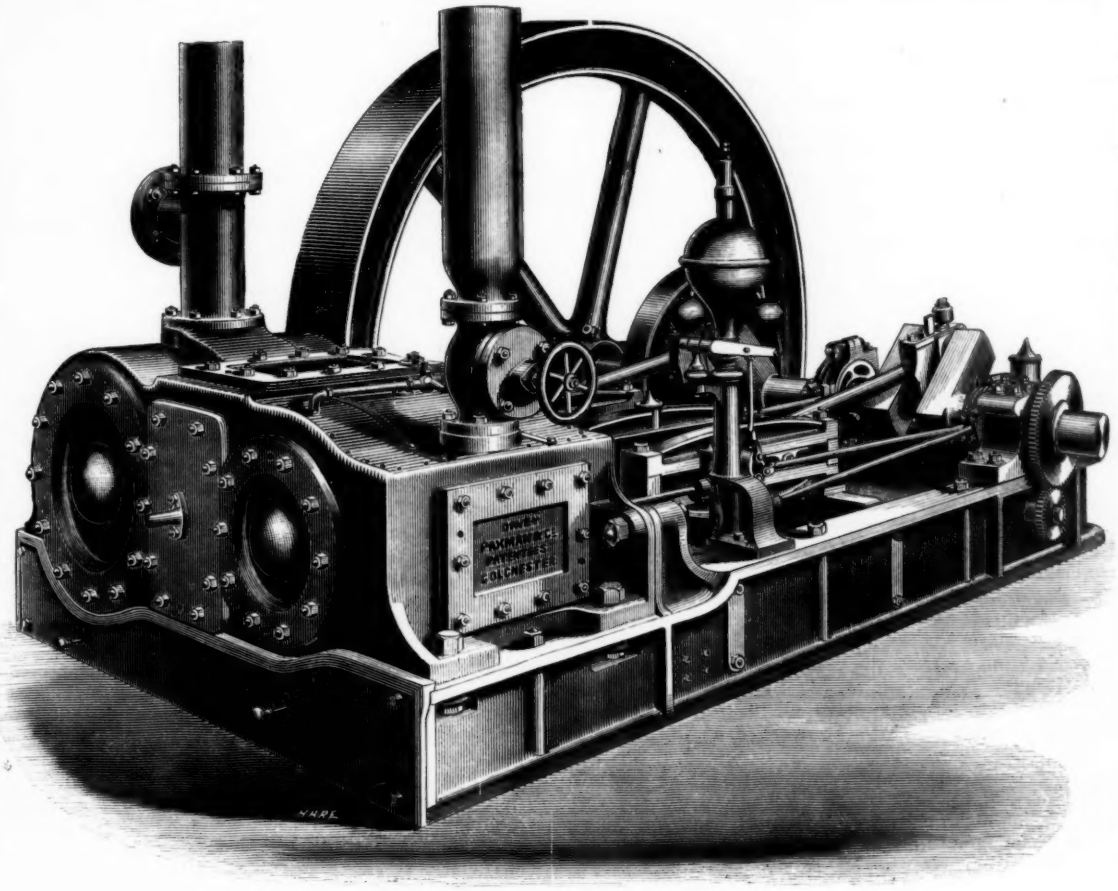


FIG. 1.

THE "COLCHESTER" ENGINE.

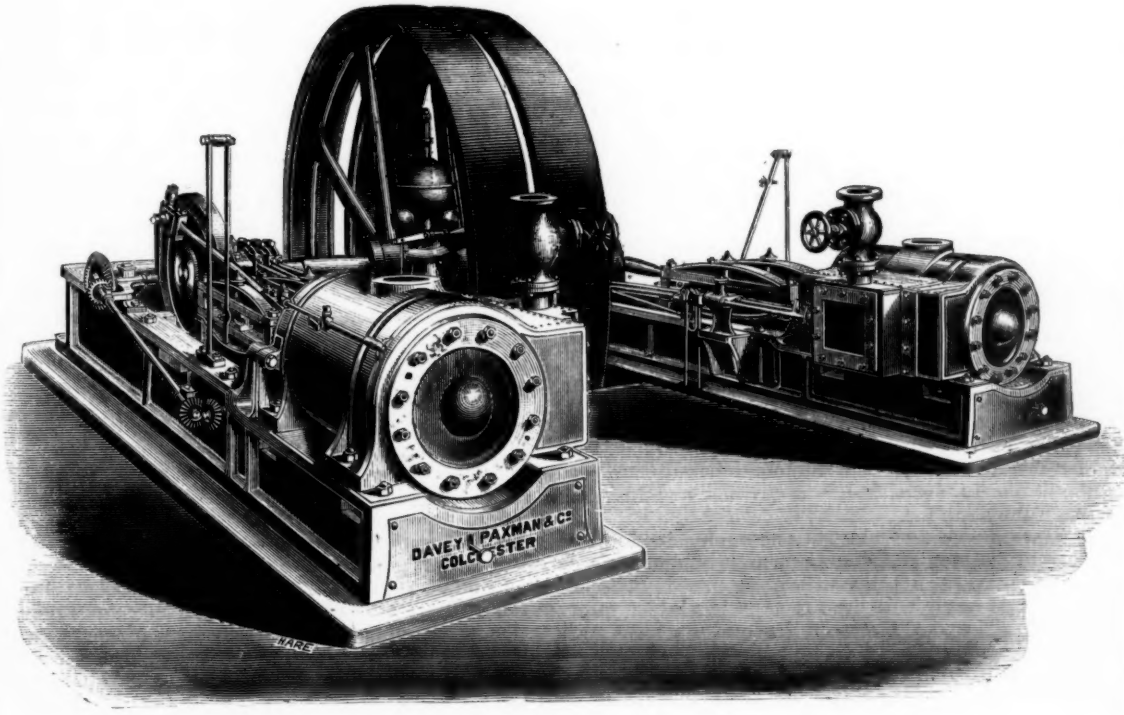


FIG. 2.

THE "PAXMAN" ENGINE.

eminent degree by the "Paxman" automatic expansion valve and governor referred to above, and this is not only in one, but in all the engines so fitted. This is the more noteworthy, that several changes have been made in the dynamos and in the way in which power is distributed, in compliance with the desires of the electricians. Thus, under varying conditions, the velocities of the engines have remained unaltered.

We may remark, in conclusion, that as far back as 1874, at the Exhibition held at South Kensington, Messrs. Davey, Paxman & Co. were requested by Mr. Bacon, the then engineer in charge, to run his line shafting at exactly 100 revolutions, and he wanted it to run regularly whether the duty was off or on. It had to drive a large French printing machine, and under the conditions above named it ran within 1 per cent. Also at the Crystal Palace Electric Light Exhibition, the same firm's engine was selected by the scientific committee to carry out their tests.

LOUIS BREGUET.

THIS eminent man, whose death we briefly alluded to in our issue of the 3rd inst., was born in Paris on the 22nd December, 1808. He was the grandson of Abraham Breguet, a most talented watchmaker, who, in perfecting every branch of his art, equalled in talent and excelled in renown the great masters Berthoud and Leroy.

The early training of Louis Breguet was entirely practical. His father apprenticed him in Neuchâtel, and he returned to Paris at the age of 18 years, as a very clever workman, but ill educated. Without neglecting the management of the practical work in his father's shops, with which he was entrusted, young Breguet sought to become acquainted with the theory and principles of his labours. Arago, a friend of his father's and soon of himself, encouraged him. It was by his advice that he attended the Cours de l'Ecole Polytechnique, and to the study of Mechanics he added that of Physics and Mathematics.

He was soon the head of an important house, the management of which his father left to him, and it required but little effort on his part to maintain the front rank amongst the most clever watchmakers. His ambition, however, did not rest here, electrical phenomena revealed to him a new path for study. His first scientific work, in which M. Masson was his co-operator, was made in 1842, but this did not receive full justice till years afterwards. Breguet and Masson prepared the celebrated apparatus of Ruhmkorff, which, without them, would perhaps have been impossible.

Amongst his labours may be mentioned his connections with experiments on light. Arago indicated a plan of experimenting for the purpose of deciding between the two theories on the mode of transmission of light. MM. Fizeau and Foucault each brought forward a special method for the solution of this problem. In these admirable experiments Breguet and Froment shared the honour of having devised the means of realization. The part taken by Breguet was so considerable that one of the authors of these beautiful conceptions wished Breguet's name to be associated with his own. When the members of the Bureau des Longitudes desired to obtain the differences of longitude by electrical means Breguet was the man to whom they applied.

The introduction of electric telegraphy in France was due to Breguet, and doubtless most of our readers are familiar with his inventions in this branch of science. His name will ever remain in the foremost rank of electricians. Over his grave two tender and touching orations were delivered by M. Janssen and Admiral Cloué respectively. In speaking of the deaths of Breguet's daughter, son, and nephew—the two latter quite recently—M. Janssen said :—

"But Breguet leaves some young children, may we not hope that they are destined to revive again a name that is dear to us? I should wish that the Academie, that the Bureau, that all of us, would consider this moral guardianship as our duty. The Breguets have done enough for the honour of industry and science to have the right of demanding this tender care.

"Oh! if anything could have consoled the aged man when he lost his son, if now anything could again animate his ashes or console his widow, it would be the firm assurance that the posterity of Breguet is under the guardianship of France, and that this name so dear to the country is destined to rise again, and to shine still in the first rank in the higher applications of science."

A NEW TELEPHONE EXCHANGE SYSTEM.

THIS system, of which Mr. A. L. Paul is the owner of the patent for this country, enables five or more telephones, which are within a short distance of one another, but at a long distance from the central station, to be connected by one main wire to the central exchange. The line wire from the exchange is brought to some place as near as possible equidistant from the telephones to be connected. Here it is joined to an instrument called the "automatic exchange." From the latter a wire is led to each of the telephones requiring to be placed in communication with the central station.

At the central station an instrument called the "transmitting switch" is placed. This apparatus, which is shown to the right of fig. 1, consists of a hand lever, *l*, and dial (similar to a Breguet A B C instrument), placed on a case in which is enclosed a spring connected to the lever. By rotating the latter from left to right the spring is wound up, and the lever, on reaching zero, is slipped and held by a catch, C. By pressing a key, K_1, in front of the instrument, this catch is mechanically released, and the spring uncoiling, the hand moves round from right to left until it reaches the last number on the dial, unless checked during the revolution. During the revolution of the hand a current from battery, E, is sent to line each time it passes one of the figures, 1, 2, 3, &c., on the dial. This current passes through the switch, S, S, to any main line wire to which connection may be made, and thence to the automatic exchange, to which this main line wire may be connected. The arrangement of the exchange apparatus is shown in principle by fig. 2. A is a small dial, $1\frac{1}{2}$ inches in diameter, on which are a number of contact points at 1, 2, 3, 1-2, 1-3, 1-4, &c., and a hand, H, capable of moving over them, This dial and hand are set in the centre of a case about 15 inches long by 6 inches wide, with a glass front. Near the dial is an electro-magnet, M_1, which attracts a movable armature every time a current passes, and turns the hand over the dial, one step at a time, by an ordinary ratchet action. Close to this magnet is placed another, M_2, which also attracts a movable armature when traversed by a current; the action of this armature is to lift the ratchet out of gear and allow the hand to return to zero on the dial, by the action of a spring. At the bottom of the case is a pair of coils, C, C, surrounding a magnetised steel bar, *m*, free to oscillate in either direction, and which of course has a tendency to be deflected, in one direction or the other, at right angles to the coils, whenever a current passes through the latter, in one direction or the other. When, say, a positive current passes through the coils from the main line wire it goes to earth through the 600 resistance; a portion also splits between the lines 1, 2, 3, &c., through the medium of the hand, H, which in its normal position is in contact with the springs, *e*, *f*, *g*, &c., but as this portion of the current has to pass through the resistances, r_1, r_2, r_3, &c., and as it is divided amongst the lines, 1, 2, 3, &c., it does not affect the bells of the instruments connected to the latter.

When the positive current, then, passes through the coil, C, C, it deflects the needle, *m*, against stop, *a*, and then the greater portion of the current is shunted

through the magnet M_1, to earth; this current moves the hand one step on the dial. If the current is reversed, then the magnet, *m*, is deflected against the contact stop, *v*, and in so doing shunts the current through the magnet, M_2, thus causing its armature to be attracted so that the hand, *h*, on the dial springs back to zero.

The working of the whole system is as follows:—Suppose No. 3 telephone on the local line No. 3 wishes to communicate with the central station, he rings up the latter by means of his magneto machine, and the rapidly reversed and momentary currents pass through the automatic exchange through the medium of the hand, *h*, which is at zero, to the main line, and through the usual drop indicator at the central exchange to earth. The operator at the central exchange key, K_2, in the transmitting switch, which, by reversing the current, actuates magnet, M_2, and returns the hand of the dial in the automatic exchange to zero.

When two subscribers—say 1 and 2—wish to communicate with each other, then the central station is instructed to this effect and he works the hand, *h*, round to the "1-2" position. Under these conditions, a spring attached to the hand, *h*, rests on the insulated segment, *n*, which is connected to the contact stop belonging to "1"; as the hand also makes contact with the contact stop belonging to "1-2," it is obvious that line 1 is connected to line 2. When the central exchange has worked the hand, *h*, round to the required position by means of his transmitting instrument, he connects the main line to the bell, D, which

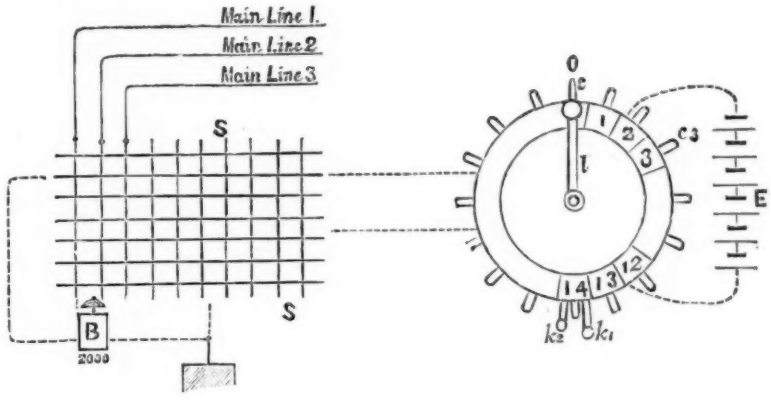


FIG. 1.

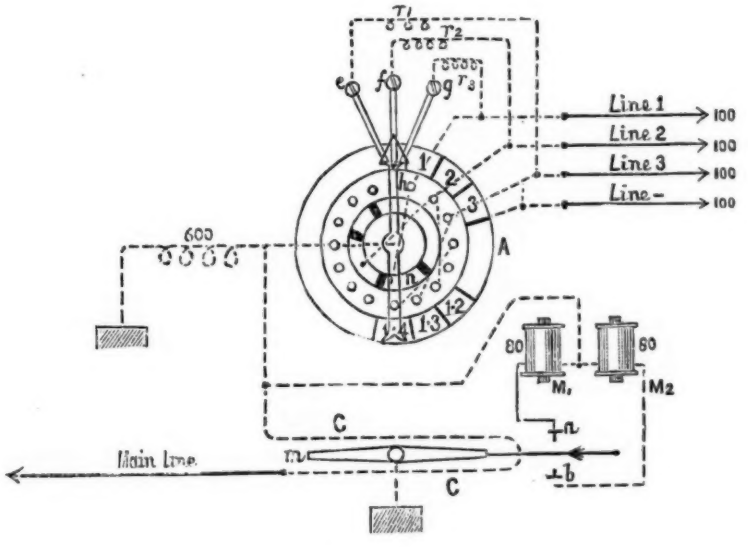


FIG 2.

sees that someone on, say, main line No. 1, has called, and he therefore connects his telephone to that line and enquires through the telephone who the caller is. Suppose he learns that it is No. 3, he then releases the hand lever, *l*, of the transmitting apparatus by depressing key K_1, the lever then moves round to No. 3 on the dial, where it is stopped by a catch, C_3, lifted by the operator. The pointer in revolving has sent three impulses of the current out to line and through the automatic exchange which have worked the hand round to No. 3 on the dial. No. 3 telephone on No. 3 local line has now exclusive possession of the main line No. 1, and the other telephones which are worked through the same automatic exchange are unable to hear what is passing, as the contact springs, *e*, *f*, *g*, are disconnected from each other. When speaking is over, the operator presses

has a resistance of 2,000; this high resistance prevents the telephonic currents passing between the two stations in communication from being "tapped" to too great an extent, whilst at the same time it enables the communicating stations, when they have finished speaking with each other, to ring up the central station and inform it that they have finished their conversation.

The apparatus contains many points of great ingenuity, which render the whole action very certain and little likely to get wrong.

The system, which was exhibited at the Vienna Electrical Exhibition, is very simple to work and seems well adapted for country purposes where there are often three or four telephones in some small town or village at a distance from the central exchange. The extra

cost of the apparatus for both ends will not, it is stated, exceed £25, and when this is placed against the cost of four or five wires, each several miles long, the great economy of the system becomes apparent. Mr. A. L. Paul, of the W. T. Henley's Telegraph Works Company, Limited, has a set of apparatus at work in the office of the company, at 8, Draper's Gardens, and can give every information on the subject.

NOTES.

Electric Lighting.—We learn that the Dublin Alliance Gas Company has purchased the plant of the late Dublin Brush Electric Light Company for the sum of £3,000. Hitherto, we believe, the Gas Company has looked upon the business of electric lighting with supreme contempt, alleging that there was really nothing in it. Now that it has, however, been induced to spend the above sum, and is already engaged in lighting a large drapery establishment by this means, we shall be anxious to know if the new light will in future meet with greater encouragement from the citizens of Dublin. Meantime we are informed the Town Council is taking exception to the right of the Gas Company to deal in electric lighting without going before the Board of Trade for permission, under the Act of 1882, while the Gas Company relies on the provisions of an Act of 1866, giving it power to manufacture and supply gas and *other improved means of lighting*, the words in italics, they maintain, including any system of lighting which may at any time be discovered, and thus, it alleges, it is entitled to use the electric light.

Messrs. Laing, Wharton and Down, agents of the Swan United Electric Light Company, last week successfully put up two installations, one to light two stalls at the late Brewers' Exhibition at the Agricultural Hall, and the other at Kendal, for a local exhibition, under very short notices. For the first, the application was made on Monday morning, and the installation was completed that evening; and for the second the order was given on Tuesday evening, and by mid-day on Thursday (the dynamo, lamps, &c., having to be taken from London), three rooms were lighted with about thirty 20-C.P. lamps, from a compound wound 30-light Gramme. The power was obtained from a portable engine, lent by Messrs. G. Gilkes & Co. (late Williamson Brothers), the well-known turbine makers.

The Leicester Temperance Hall, on the occasion of a fancy fair held recently, was illuminated with the electric light by the Pilsen-Joel Company, through their agents, Messrs. Gent & Co., Leicester, the lamps used being five Pilsen arcs and 60 incandescents. The current was generated by two large dynamos of the company's manufacture, driven by a portable engine of 8 H.P.

An application of electric lighting was made on Friday night, Nov. 9th, by Messrs. Shippey Brothers, who lighted the carriage in which the late Lord Mayor rode to and from the banquet with the new "Universal" glow lamps. The current was generated from a Coad's patent primary battery in combination with the "Woodward" storage battery, placed under the coachman's seat. The installation was arranged on the principle adopted in fitting the electric light to the carriage of Baron Rothschild in Vienna.

The Guildhall, on the evening of the Lord Mayor's banquet, was illuminated with the electric light. In its description of the presentation of the distinguished guests, *Lloyd's* says:—Unfortunately the electric light immediately over the daïs flickered and disappeared, leaving the gorgeous group in comparative shadow.

The Paris correspondent of the *Daily Telegraph*, writing on Monday evening, says:—Electric lighting is again coming to the fore in Paris. Tne Director of the Postal and Telegraphic Department, M. Cochéry, has just had 1,200 lamps put up in the general office in the Place du Carousel. The lamps are supplied by the Faure accumulators, and the steady even light obtained by this means has decided the enterprising Postmaster-General to give the system the comparatively long trial of 18 months. The Continental Hôtel was also lighted up for the first time last night by the same system, the stored electrical energy being brought to one of the doors of the hotel in a cart. Communication with the candelabra in the largest room of the first floor was established in a few moments, in the presence of some 300 visitors. Many of those present afterwards journeyed to the Arc de Triomphe and back in a tramcar propelled by electricity supplied in the selfsame accumulators, by way of testing the availability of the power thus stored. I hear from Berlin that a contract was signed there yesterday, by virtue of which the Edison Company has purchased for the whole of Germany the right of using the Faure-Sellon-Volckmar accumulators, the arrangement being made through the instrumentality of Messrs. Landauer and Sulzbach. I hear also that the Electrical Power Storage Company is to receive before the end of the year £30,000 for its rights, and that £10,000 have already been paid in cash.

The Swan light has just been introduced into the Beemont Dye Works for the purpose of matching and shading colours during the night, and has proved very satisfactory. The current is produced by two Lumley machines capable of lighting seventy-five 20 C.P. lamps. Safety fuzes are used in every circuit, which melt with 20 per cent. extra current. Mr. W. Banks of Bolton has had charge of the installation.

After extensive alterations and redecoration, Messrs. Gatti's Adelaide Restaurant, Strand, is now lighted by means of about 330 Edison incandescent lamps. A special feature in connection with the lighting is the duplication of the generating plant. There are two "Field" boilers, two "Armington" engines, and four Edison dynamos. The steam piping is so arranged that either engine can be run from either boiler, and the shafting so that any two of the dynamos can be driven by either engine. If one boiler should fail the other would supply sufficient steam to drive one engine; if one engine stopped the other would still run two dynamos, which in turn could sustain the entire number of lamps. The most careful provision has thus been made to guard against the possibility of a break in the lighting through any accident to the machinery.

An interesting series of experiments, with the object of utilising the electric light for war purposes on land, have just been concluded at Shoeburyness, and is understood to have given much satisfaction. One portion of the experiments was devoted to the test of heavy and small arm fire to extinguish the light. The gunners were unsuccessful in their efforts to destroy it, and though a picked body of riflemen succeeded in getting numerous bullets on the reflector and bent the wire, their attempts were equally unsuccessful.

It is said that the extinction of the Edison electric lamps in the first district of New York City, which occurred on the night of the 23rd ult., was occasioned by the weather. Major S. B. Eaton, president of the Edison company, gave the reason for the occurrence as follows: "It was," he said, "caused by the extraordinary large load of lights, due to the dark and rainy day. The load burned out the lead in the safety catches used throughout the underground conductors to guard against fire, and the lamps went out. New safety catches in the leads are now being inserted, and as soon as that can be done all the lamps will burn again as usual. Hereafter larger leads will be used, and a similar accident will not occur again."

A Penny Telephone.—Mr. John W. Batten, 35, Palace Gardens Terrace, in a letter in the *Times* of Wednesday week, asks if it would not be possible to establish a system of penny telephone messages throughout London. "I have a firm belief," he says, "that it is

not only possible, but that it would become profitable, and if the Government would assist by taking the tax off all penny messages just as they have taken the passenger duty off all railway fares at a penny per mile, we would, at any rate, try the experiment, and open, say, 100 offices in different parts of London." Mr. Batten gives the subjoined statement, prepared from the books of the United Telephone Company, showing the results of one week's working, and adds that from it, it would be seen at a glance that the number of telephonic messages already exceeded that of the postal telegrams, and that the average cost of a message was under one penny.

Area.	Date.	Number of Subscribers.	Calls.	Number of Messages, allowing the minimum of 2 to each call.	Average per Subscriber.	Cost per Message, exclusive of Government duty.
						d.
5 miles from G.P.O.	Monday, Oct. 15 ...	3,081	21,371	42,742	13·87	·86
	Tuesday, Oct. 16 ...	3,084	21,707	43,414	14·07	·85
	Wednesday, Oct. 17	3,086	21,841	43,682	14·12	·85
	Thursday, Oct. 18	3,087	21,645	43,290	14·02	·85
	Friday, Oct. 19 ...	3,090	22,636	45,272	14·65	·81
	Saturday, Oct. 20...	3,090	14,583	29,166	9·43	1·27
			123,783	247,566	80·16	5·49
	Average		20,630	41,261	13·36	·91

Post-office postal area, 12 miles from G.P.O.	Total number of Messages 12 months ending March, 1883	12,374,707
	Weekly average	237,975
	Daily average	33,996

Seventy-two Messages at a Time Over One Wire.—The Standard Electric Manufacturing Company, of this city, says the *New York Evening Post* of the 25th ult., has been organised for the introduction of a system of telegraphy by which one wire can be made to do the work of a dozen, or, if necessary, of 72 wires. The principle is one upon which many attempts have been made to accomplish the same result—the use of a toothed wheel which makes or breaks the current as its teeth sweep past the connecting stylus or brush, each tooth having a corresponding tooth in the receiving wheel, which may be in another city. The wheel used by the new company contains 72 teeth. Any one conversant with electrical matters will perceive that if the wheel in Boston, for instance, can be made to revolve in perfect synchronism with the New York wheel, that there could be 72 messages going over one wire, for if each one of 72 receiving instruments could receive the current during the fraction of a second during which the sending instrument passed over its particular cog, that would be sufficient for practical purposes, as the wheel revolves at the rate of 170 rotations a minute. If only one cog in the wheel were to send a click to Boston every time the connecting brush passed over it, and that click advanced a clock-hand around a dial having letters instead of minute marks, it will be seen how a message could be sent. The dial-hand would more forward regularly, one letter for every turn of the wheel in New York, until the desired letter was reached, when a pause would indicate that that letter was to be written down. If two cogs in the sending wheel sent an electrical impulse through the wire the dial-hand would move forward twice as fast, but it has been found that one cog in a wheel rotating 170 times in a minute gives a speed sufficient for business purposes, and enough to enable as many messages to be sent every day as two business houses constantly in communication desire to exchange. The great trouble with this system has been heretofore that absolute synchronism has not been obtained. Two chronometers, even regulated by electricity, do not move together with sufficient evenness, as the variation of the six-hundredth part of a second or more renders the machine useless. The new device consists in introducing a certain number of regulating cogs, which send a retarding current in case one machine runs faster than the other. Where it is desirable to use the Morse sounder, the wheel is divided in 12 parts of six cogs each, and one cog in each of these 12 divisions sends a pulsation to one of 12 machines at the other end of the line. The pulsations then come so close together that the sound resembles a continuous hum, and the Morse sounder can be used as a "make and break" instrument. When employed simply to move forward the dial-hands of each of 72 instruments, the cost of renting such a convenience will be only a trifle of that charged by the telegraph companies for a private wire, besides which no trained operators are necessary to send and receive messages.

Speed of Working on Submarine Cables.—As so much interest is being taken just now in the matter of Atlantic telegraphy, it may be as well to give the following facts, which were published by our contemporary *Engineering* in a recent issue. It says:—"According to recent trials of the speed of working on the Jay Gould cables laid across the Atlantic from Penzance to Canso, in Nova Scotia, 1,000 code words were sent from Penzance and received at the Canso station in 81 minutes, including all repetitions and corrections. The 1,000 words consisted of 7,288 letters, which is about equivalent to 1,458 words of five letters each, the average number for the English language. The above rate of transmission is therefore equal to eighteen words of five letters per minute." The weights per mile of the gutta percha and the copper in these cables are, we believe, 340 lbs. and 350 lbs. respectively.

Telegraph Extension in Orkney.—In reply to a petition addressed to the Prime Minister, praying for an extension of the telegraph system to the fishing station at Holm, and pressing upon the Government that in cases of telegraphs connected with such a food-producing industry as the herring fishing, it would be right and generous to relax the hard and fast rule requiring heavy guarantees, and pointing out that a single shilling message might at any time secure as great a value in herrings in one night as would pay for the extension over and over again, the Postmaster-General says that under the regulations of the Treasury he is precluded from recommending the extension except under guarantees, and that the annual sum required to be guaranteed for the Holm extension is £76 for seven years. He further states that the terms on which telegraph offices are established under guarantees are based on principles which had been adopted as just, and that, looking to the heavy present and prospective loss in the telegraph revenue, their lordships did not feel justified in departing from them in any case.

Electric Lighting Engines.—Messrs. Willans & Robinson, writing to *Engineering*, say:—It is stated, on no less authority than that of *Engineering*, that dynamo-electric "machines running at 600 or 700 revolutions per minute cannot well be driven direct." It has not suited us to bring prominently before the public, as yet, the results attained in driving dynamos by the Willans engine, and we cannot complain that what is not known is not spoken of, but as so definite a statement has been made, perhaps you will kindly allow us to refer briefly to the subject. The engine which lights our machine shops is an ordinary Willans compound launch engine, and as the Burgin machine which it drives is necessarily driven by a belt, there is no occasion to run the engine fast. It runs therefore at less than 400 revolutions, or considerably below its normal speed as a boat engine, We have, however, another and smaller compound engine coupled direct to a 100-light Siemens machine. This runs for the particular purpose required at 600 revolutions, and for the satisfaction of the purchasers it was last week run at that speed continuously for ten hours every day, and it is certain that it might equally well have been run continuously for the whole week, day and night, without stoppage. It required and received no attention beyond replenishing the one impermeator once in from six to ten hours, and putting a little oil in the crank chamber once daily.

At the end of the week the bearings showed no sign of wear, and will not when they have done the same work for months. There was no noise and no vibration, and would not have been had the speed been even largely increased. The weight of this engine is about 1¼ cwt. It requires no flywheel, and it possesses the advantage of being convertible, by merely shifting a lever, into a simple engine. It then takes the steam directly into the low-pressure cylinders, and will give out the same power as before at a very much reduced pressure—a considerable advantage if, from any cause, the usual pressure of steam should not be available. When working compound the consumption of steam is extremely small. Last winter we made a special engine which ran at 1,100 revolutions with smoothness and quietness. But we had no sooner achieved this than we found an evident turn in the general feeling on the subject in favour of lower-speeded machines, and now, as it appears to us, the tendency is either to use machines running so fast (1,500 to 2,000 revolutions) as to put direct driving practically out of the question, or to work at speeds such as 600 or 700, which can easily be dealt with by the ordinary and well-tried types of the Willans engine. We have some engines here now just completed for the English Admiralty designed to drive direct at 550 and 600 revolutions, and we find that in that quarter at least the tendency is towards the adoption of still lower speeds.

The Hammond Electric Light and Power Supply Company, Limited.—The following circular has been issued by the above company, and our remarks on the same will be found in our other columns:—"A few months ago there was brought under the notice of this company a system of lighting trains by electricity which utilized and stored up the energy of the train in down grades, and we immediately put in hand the necessary apparatus to apply the system. The first set of apparatus is now made, and from the trials in the works gives promise of perfectly fulfilling its object. It will, however, be fitted at an early date into a train upon one of our principal railways, but in the meantime we beg to advise you that this system will, if successful in practice, completely solve the problem of lighting trains by electricity on an economical and reliable basis, since it does not depend upon chemical means, involving the constant consumption of expensive material, but relies solely upon the utilization of the movement of the train, and by a system of storage of this energy the lights will continue to burn during any stoppage that may occur."

Lighting the Interior of Boilers.—The manager of the Sectional Boiler Works, Birmingham, writes to *Engineering* as follows:—On account of the novel application, and as we think it will interest many of your readers, we take the liberty of informing you that we have demonstrated the possibility of lighting up the interior of our steam boilers with electricity. Having adopted for some of our sectional boilers on Root's and other systems, reservoirs of considerable diameter within which are placed deflectors for separating the steam from the water, which circulates throughout the system, we thought it would be instructive to render visible the action which goes on. The application, which has been carried out by our engineer, Mr. Lane, with whom the idea originated, is perfectly successful, the cascades, currents, and miniature whirlpools being clearly observed. We think the system of lighting up steam boilers very important to the world at large, as the cause of priming and most effective mode of separating the steam from the water, may in that way be more thoroughly investigated. We shall be pleased to show our arrangements by appointment to all interested.

The Armington & Sims Engine.—The Armington & Sims Engine Company, Providence, R. I., has, we understand, just shipped to the London Edison Electric Light Company another Armington & Sims engine for their electric light plant. Would it not be worth the while of one of our prominent firms of engineers to turn their attention to the construction of a similar engine?

Separating Metals by Electricity.—The *Times* says:—A very ingenious method of separating metals from their alloys by electrolysis has been perfected by Mr. E. J. Atkins, and has recently been shown in practical operation at No. 277, Rotherhithe New Road, where it has been inspected by a number of gentlemen interested in mining and metallurgy. The experimental trials were illustrated by the treatment of base bullion, which ordinarily consists of gold, silver and copper. In the Atkins process the alloy is suspended in a bath of dilute sulphuric acid contained in porous conductive cells placed in tanks containing a solution of sulphate of copper, in which plates of copper are suspended. The alloy and the porous cells are connected by means of copper rods with the positive pole of a Gramme dynamo machine, the copper plates being similarly connected with the negative pole of the machine. The current of electricity passes through the alloy to the acid solution, which is thus decomposed and combines with the oxydisable metals, such as silver and copper, producing oxides of those metals which enter into solution. The more negative metal, in this case gold, not being affected is thrown down and afterwards removed from the bath, washed, smelted, and run into ingots and bars in the usual way. The silver and copper are also recovered separately and are similarly treated. One special feature is that the sulphuric acid in solution is used over and over again, and hence a great economy is claimed, as well as by reason of the metals being separated in a perfectly pure state. The apparatus, moreover, is simple and inexpensive, consisting of nothing more than the dynamos with their driving power and the tanks and connexions. Other alloys than that under notice are capable of treatment by this process, modifications being made in the apparatus and the solutions. The working of the process is almost automatic and involves but little labour, while the atmosphere is comparatively free from acid vapours. The process is being introduced by the Electrolysis Company, of No. 49, Queen Victoria Street, London. *Apropos* of this matter, Messrs. Watney, Tilleard and Freeman, in writing to the *Times* under date of the 12th inst., say:—"The attention of our client, Mr. Henry R. Cassel of New York, having been called to the paragraph in the *Times* of the 8th inst., on the new method of separating metals by electricity, we are requested to inform you that Mr. Cassel is the sole inventor and the patentee of the process which you described, under Letters Patent granted to him on the 26th of September, 1882, and numbered 4,580. We are also instructed that Mr. Atkins, whose name you mention as the inventor, was, until a very recent date, in the employ of our client in America, and so gained such knowledge of the subject as he may possess; but neither he nor the Electrolysis Company have any patent, and proceedings are now pending in regard to Mr. Atkins's attempts to make use of our client's invention. We trust that, in fairness to Mr. Cassel, you will give this letter a place in the *Times*, as the statement in the paragraph referred to that another person is the inventor of the process is likely, if not publicly contradicted, to operate to the detriment of our client, who is now in this country making arrangements for the introduction of the invention."

The International Fisheries Exhibition.—On Saturday last the exhibitors of the electric light and representatives of the scientific Press were entertained to dinner in the building at South Kensington by the executive committee of the Exhibition. Mr. Crossman presided, Sir Philip Cunliffe Owen and Mr. A. B. Burdett-Coutts being vice-chairmen. In proposing the toast of "Electrical Science," the chairman acknowledged that without the electric light, which had made it a palace of enchantment, the exhibition just closed

could not have been such a thorough success. Mr. Willoughby Smith, president of the Society of Telegraph Engineers, responded, and at the close of his speech referred to the blinking, hissing and winking of the arc lights in the room—a remark which the following speaker, Mr. Alexander Siemens, dealt with very happily by asking—What did it matter? The defects referred to had not prevented that assembly from enjoying their dinner, nor stood in the way of the lighting of the exhibition being accomplished in a manner impossible with any other illuminant. Sir Philip Cunliffe Owen, on behalf not only of the executive committee, but also of the millions who had visited the Exhibition, expressed his indebtedness to the following electric light exhibitors:—Messrs. Siemens Bros. & Co., Swan Electric Light Company, Gülcher Electric Light Company, Jablochkoff Electric Light Company, Henry Edmunds (Hochhausen), Ferranti Thomson & Ince, British Electric Light Company, Pilsen-Joel Electric Light Company, Elphinstone-Vincent, Electrical Power Storage Company, Ball's Unipolar Company, Gérard Electric Light and Power Company, Electric Light Supply Company, Woodhouse & Rawson, and F. L. Willard. Thanks were also presented to Messrs. Davey, Paxman & Co., who supplied the motive power, and to Colonel Festing and Mr. Gooch, who were responsible for the arrangements. In acknowledging the toast of his health, the chairman concluded by asking permission to refer to the great services rendered to the exhibition and to the public by Mr. Burdett-Coutts, who thereupon acknowledged the compliment and brought the proceedings to a close by a graceful reference to the interest taken in the Exhibition by the Baroness Burdett-Coutts, and to her persevering efforts in the direction of providing the poor of London with cheap food.

Overhead Wires.—Patrick Downie, twelve years of age, while on the top of a tramway car on Govan Road, Glasgow, on Saturday evening last, was struck on the arm by a broken telegraph wire which fell from overhead. He was fortunately only slightly hurt.

The Royal Society.—The council of the Royal Society, in preparing for the anniversary meeting, has awarded the medals for the present year as follow:—The Copley medal to Prof. Sir Wm. Thomson, F.R.S., for—(1) his discovery of the law of the universal dissipation of energy; (2) his researches and eminent services in physics, both experimental and mathematical, especially in the theory of electricity and thermo-dynamics; a Royal medal to Prof. T. A. Hirst, F.R.S., for his researches in pure mathematics; and a Royal medal to Prof. J. S. Burdon-Sanderson, M.D., F.R.S., for the eminent services which he has rendered to physiology and pathology.

The James-Hueston Cable.—"It is reported," says the *N. Y. Herald*, "that the James-Hueston cable will land on long Island. We consider this a mistake. The distance from Europe is too great, and the cable will be greatly in danger from the fishing fleets. All the cables now laid by the present cable ring saved this extra three hundred miles cost by running into Cape Ann, Cape Cod, and some into Halifax. This is our opinion and we give it for what it is worth." To the above, Mr. J. C. Hueston publishes the following reply:

"The *Herald*, commenting on a published report that the cables of the new company, of which Gen. James is President, are to be landed on Long Island, thinks such a course would be unwise, because of the greater length and of increased risk of interference by fishing vessels. The company has made no authoritative announcement of its intention in this matter; but with improved cables and methods of working, 300 extra miles in the main line would not be of much importance, while the whole number of miles from New York to London by such a direct route would be fewer instead of greater than by Newfoundland or Nova Scotia. There would not be so many repetitions as on the old route, and messages would be proportionately expedited. The increased danger from interference by fishing vessels is even less apparent, since the fishing grounds lie far to the northward of the line such a cable would follow. That the existing cables do not enjoy immunity from such interference is shown by the frequent interruptions to which they are subject, three of which during the month of August last, I am informed, were attributed to fishermen. The direct cable, which lands in Nova Scotia, was cut three times before it was a year old."

Magneto and Dynamo-Electric Machines.—Mr. J. Angelo Fahie has published, in pamphlet form, the paper, bearing the above title, which he read before the Institution of Civil Engineers of Ireland in December last. Messrs. E. & F. N. Spon are the London agents for Mr. Fahie's production, which is profusely illustrated.

The New Patent Act.—We have received a pamphlet entitled "A Summary of the New Patent Act, 1883," compiled by Mr. W. Lloyd Wise, and which has been reprinted from our contemporary *Engineering*. It is published at the offices of that journal, Bedford Street, Strand, W.C. The author's name is sufficient to recommend his publication to all those interested in patent matters.

Portable Miner's Lamp.—A correspondent wishes to know if any of our readers can reply to the following questions relative to the prize of £500 offered by Mr. Ellis-Lever for the best portable miner's lamp:—Must it be an electric lamp? If so, would a combination of a new battery with an already known lamp be accepted? What approximate amount of light required (in standard candles), and for how long at a time? Maximum weight of the whole apparatus, the last day for sending in, and to what address?

The Distribution of Electricity.—The National Company for the Distribution of Electricity has now, by the use of Messrs. Gaulard & Gibbs' "secondary generators," lighted up the stations of Edgware Road, Notting Hill Gate, and Aldgate, on the Metropolitan Railway. The dynamos employed are those of Siemens, generator and exciter, placed in the old fitting shops at Edgware Road. The lamps used at each station are Jablochkoff arcs and Swan incandescents. The total length of the primary circuit is between 14 and 15 miles. Two more stations—Gower Street and King's Cross—are shortly to be illuminated by the same means. Technical details of this installation would be most interesting.

Stabbing of Electric Light Workmen in Paris.—In Paris on Monday night four Englishmen, named Bowes, Pope, Hodge, and Forstmeister, in the employment of the Swan Electric Light Company, were dangerously stabbed by four Parisian roughs in consequence of their having protected an Alsatian whom the ruffians were endeavouring to strangle.

The Dangers of Electric Lighting.—The city of Dayton, O., U. S., America, is lighted by the Fuller system, the lamps being suspended at the intersection of the streets. While President Chandler, of the National Fuller Electric Light Company, President Lowes, of the Dayton Company, and Superintendent T. R. Robbins, also of the Dayton Company, were making a tour of inspection in the rain on the night of the 12th ult., a lamp in the business centre of the city went out. Superintendent Robbins, in lowering the lamp, to examine it, took hold of the conducting wire where the insulation was worn off and fell as if shot. Before he died, which was three minutes later, he said "the life is burned out of me."

Eight Letters about Threepence.—An amusing correspondence has lately taken place between the post office authorities of Edinburgh and London and Mr.

G. H. Thoms, Sheriff of Caithness, about the word "etcetera," used in a telegram sent by Mr. Thoms from Thurso, and accepted by the post office official there as one word, and paid for as such. The authorities subsequently wrote Mr. Thoms requesting the additional sum of 3d., explaining that the "two Latin words et cetera" could not be accepted by the post office as one word. Mr. Thoms replied, declining to remit the 3d. demanded, stating that he used no Latin words in the message he sent, but the English word "etcetera." The result of the correspondence, eight letters in all, dating from the 14th May to the 11th October, was that, after the post office had intimated that they would take no further action in the matter, Mr. Thoms forwarded the 3d., with the request that it should be paid to the poor girl who accepted the message, whom the post office "boast of having mulcted" to that amount.

Obituary.—Mr. J. Gibbs, telegraphist, who erected the first land line in Belgium—from Brussels to Antwerp, in 1839—died in Belgium on the 2nd inst., aged 80 years. He was one of the delegates of the Belgian Government at the Telegraph Conference held in London in 1879, and was pensioned by the Belgian Government on the 1st October last. Mr. Gibbs was originally engaged by Messrs. Cooke & Wheatstone.

Improvements in Electric Batteries.—The action of the element is regulated by non-porous screens which slide over the porous cells. The outer vessels are widened below the plates and cells so as to permit of the use of a large quantity of liquid.—*Wiedemann's Beiblätter.*

On Electrical Ring Figures.—By A. Righi.—If a discharge is conveyed through a point upon a dielectrical plate which has beneath a conductive coating, we sometimes obtain on dusting the plate with red lead and sulphur, if the charge is positive, instead of a yellow star, a yellow ring, with a reddish, indistinct disc in its middle. If the charge is negative, we obtain instead of the red disc a very regular red ring in which there appears a red star.

The cause of the phenomenon is as follows :—

If upon a perfectly insulated sewing-needle, fixed over a horizontal disc of ebonite and provided with a ball above, a spark is allowed to issue from the inner coating of a jar, and if the plate is dusted, there appears the well-known figures. If, however, the needle is badly insulated, or if it is touched with the hand, the rings appear.

On supplying, *e.g.*, positive electricity by means of the point, the upper surface of the ebonite is at first charged positively and the under surface negatively. If the point is badly insulated the upper surface is again discharged and negative electricity passes over upon it. If the quantity of electricity discharged is smaller than that supplied by the charge, then the middle only of the charged part becomes negative and the circumference remains positive.

If the point is too far removed from the plate there appears only the ordinary figure; if it touches the plate, and if a second point is applied above it, we obtain certainly the rings, which belong therefore to the figures from which Bezold sought to deduce the oscillations of the charge.

If the ebonite disc is moved in its plane, the internal space of the ring is displaced towards the point, or it ceases to be circular.

If the point and the posterior surface of the ebonite disc are connectd with the conductors of the Holtz machine, the disc turned a little, and the conductors pushed together, we obtain likewise on dusting, from the reasons mentioned above, the ring-figure. If, after charging the plate, both the point and the coating are thoroughly insulated, and if the plate is slowly and continuously dusted, touching alternately the point and the plate, we obtain in succession larger and larger rings.

If the experiment is conducted in the ordinary manner, but if a badly conducting medium—a glass tube filled with water—is placed between the point and the coating of the plate, we obtain rings; the ebonite plate being first charged and then discharged by the column of water.—*Weidemann's Beiblätter.*

New Chromic Acid Battery.—By M. Monci.—Six glasses perforated at the bottom are set in a lead tray, fitted with a lead syphon for running the liquid in and out. In each glass there is a zinc plate and two carbon plates. As liquid is used a solution of one kilo bichromate of potash in 4 litres of water and 2 litres of hydrochloric acid.—*Wiedemann's Beiblätter.*

On the Resistance of the Electric Arc.—By O. Frölich.—If we determine the potential difference, E, at the electrodes of the arc and the strength of the current, J, then, E/J, is the apparent resistance of the arc, which may be composed of the real resistance, and an electromotive force.

In a graphic representation of the arc-lengths, L, as abscissæ, the potential differences as ordinates, the strongly indented curve oscillates about a gradually ascending right line, whence $E = a + b\,L = 39 + 1{\cdot}8\,L$, if L is measured in millimetres and E in volts. The apparent resistance, W, of the arc is then—

$$(1.)\quad W = \frac{a}{J} + b\frac{L}{J}$$

If there exists an electromotive force or polarisation, P, of the carbons, and if k is the conductivity and Q the section of the arc, then—

$$(2.)\quad E = P + \frac{J}{k}\frac{L}{Q};\quad W = \frac{P}{J} + \frac{1}{k}\frac{L}{Q}.$$

If there is no polarisation, and merely a resistance to transit, U, then—

$$(3.)\quad E = \frac{U}{Q}J + \frac{J}{k}\frac{L}{Q};\quad W = \frac{U}{Q} + \frac{1}{k}\frac{L}{Q}.$$

If the formulæ (2) and (3) agree with (1) the section of the arc must be proportional to the strength of current, therefore Q = const. J. If const. = 1 or Q/J = 1, then a is the limit of the polarisation or of the resistance to transit for the section 1, and b the inverse value of the conductivity of the arc. The formulæ do not give a decision for either assumption.

The work in the arc is—

$A = E\,J = (a + b\,L)\,J$. It is, therefore, proportional to the strength of the current, and, though remotely, to the strength of the light.

The observations have been made at the establishment of Siemens & Halske with arc-lengths of 1 — 16 *mm.*, and with strengths of currents of 4 — 120 ampères.—*Wiedemann's Beiblätter.*

On Hall's Phenomenon in Liquids.—By A. Raiti.—The author has observed Hall's phenomenon with silvered and platinised plates of glass. In opposition to Hall's explanation that the current is deflected by the magnet without any participation on behalf of the matter, he brings forward the following experiment:—

Two fine silver wires, of only 0·03 *mm.* in thickness and 4 *cm.* in length, which are soldered to thick copper wires, are bent at right angles and connected together in the form of a cross. The copper wires are fixed to a wooden frame, and the two which are diametrically opposite to each other, A and B, are connected with a galvanometer. The two other wires, C and D, at their point of union with the copper wires, are kept stretched in a diametrical direction by very fine wires coated with silk, carried over pullies and loaded with weights. Their other end, which is coiled spirally, is connected with a chain by means of pressure-screws. If the wooden frame was brought into an equatorial position between the poles of a magnet so that the intersection point of the wires lay in an axial direction, the deviation in the galvanometer was altered with a feeble tension of C and D, whereby C, D is raised or lowered by the electromagnetic action,

so that the contact becomes more or less intimate. If the tension of C, D is strong, no change occurs in the deviation produced by magnetisation, even by a current of 6 Daniells.

On applying a large Ruhmkorff electro-magnet (in the first place without exciting the magnet), the deviation of the astatic mirror galvanometer with many coils, introduced between A and B, was compensated on passing the current through C and D by means of a branch of the same primary current, this branch being conveyed in a second pair of coils round the needle of the galvanometer. On exciting the electro-magnet by 16 Bunsen elements, the new position of the needle was observed and Hall's phenomenon was recognised again.

The author remarks that if, according to Hall, we suppose the potential difference in the conduction points of a slip of metal proportional to their distance and to the density of the primary current, it would be independent of the distance and of the breadth of the plate.—*Wiedemann's Beiblätter.*

The Jablochkoff Electric Light and Power Company, Limited.—The petitions of Mr. James Willing, Junr., 353, Strand, W.C., and Mr. Arthur Stuart Pennington, Bolton, for the winding up of this company, which were set down for hearing before Mr. Justice North on Saturday, were not reached, but at the rising of the court they were mentioned by Mr. Higgins, Q.C., counsel for the company, and a special examiner was appointed to examine witnesses and to report to his lordship. The petitions will again come before Mr. Justice North to-day. Since going to press we hear that the first petition is withdrawn.

London and Provincial Electric Lighting and Power Generating Company, Limited.—Mr. Justice Chitty has fixed November 19th, at 12, at his chambers, for the appointment of an official liquidator.

OFFICIAL RETURNS OF ELECTRIC COMPANIES.

French Electrical Power Storage Company, Limited.—By an agreement dated 3rd inst., the shares in this company numbered 75,001 to 80,000, allotted to the Faure Electric Accumulator Company, Limited, are rescinded and cancelled, the Faure Company having refused to accept them by reason of the same having been, by an agreement of 20th Jan., 1883, previously agreed to be subscribed for by M. Simon Phillipart and the Société la Force et la Lumiere. In lieu of the said shares the company will issue another 5,000 shares to the Faure Company.

Faure Electric Accumulator Company, Limited.—The annual return of this company, made up to the 10th July, was filed on the 8th of September. The nominal capital is £1,000,000, divided into 80,000 ordinary shares of £10 each and 200,000 deferred shares of £1 each; 47,000 ordinary and 100,000 deferred shares have been taken up, £5 per share has been called upon the former and the full amount upon the latter. The calls paid amount to £448,009 and unpaid to £50,850. The sum of £50,854 has been paid upon 25,427 shares forfeited. This return shows an increased issue of 19,372 ordinary and 50,000 deferred shares, as compared with the return of last year.

Hygienic and Electric Association, Limited.—The statutory return of this company, made up to the 5th inst., was filed on the 10th, but of the capital of £12,000, in £10 shares, the only shares at present taken up are the seven subscribed for by the signatories to the memorandum of association. Registered office, 285, Lake Road, Landport, Hants.

Croydon Electric Light.—The return of this company, made up to the 14th of March, was filed on 15th March. The nominal capital is £5,000, in £1 shares. 590 shares have been taken up and 5s. per share called thereon, the calls paid amounting to £963, leaving £51 5s. unpaid. Registered office, 3, Victoria Mansions, Victoria Street, S.W.

WARRANT OF ATTORNEY.

Cursons, Henry Dean, 163, Central Street, City Road, carpenter, and **Robert Francis Lord,** 133, Central Street, City Road, telegraph instrument maker, to Morris Harris. Dated October 25th; filed October 31st. £14.

CITY NOTES, REPORTS, MEETINGS, &c.

The Hammond Electric Light and Power Supply Company, Limited.

AN extraordinary general meeting of the Hammond Electric Light and Power Company, Limited, was held at the Cannon Street Hotel on Saturday, for the purpose of considering, and if considered expedient, passing, certain resolutions, which we published in our last issue, amalgamating the Yorkshire Brush Electric Light and Power Company, Limited, the Birmingham and Warwickshire Brush Electric Light and Power Company, Limited, and Ferranti, Thompson and Ince, Limited, with the Hammond Company. Sir Charles Young presided.

The Secretary (Mr. P. A. Latham) having read the notice convening the meeting,

The Chairman said: Gentlemen, the notice convening the meeting contains three separate resolutions, which I am going to ask you to pass to-day, if you approve of them. You will observe that all of them deal with the policy of amalgamation, or, as I should prefer to call it, consolidation. By the way in which the circular convening the meeting has been received, it appears to be a policy which commands your assent. The existence of a great many competing companies has induced many would-be customers to withhold their orders on the plea that they never know which is the best system, and really they seem always waiting for somebody to come out and do the work of lighting for nothing. The result of this has been that a great deal of installation work has been done practically for nothing; and the various companies and various systems have been thus more or less cutting each other's throats. No doubt a great deal of the success of the Fisheries Exhibition was due to the brilliant way in which it was illuminated. But that kind of business—lighting for nothing—cannot be done. Our view is that there should be a proper business-like understanding between the lighting companies, and the first step in this direction, we think, is to consolidate the existing business as far as we can, and by so doing lessen the expenses. Circumstances have rendered it desirable that we should re-absorb two of the sub-companies we formed some time ago, in Yorkshire and Warwickshire. And after a great deal of negotiations we have met each other in the terms embodied in the agreements before you. Electric lighting has not turned out the very simple affair many people thought it would be during that rage for buying concessions. A good many of these sub-companies are now being wound up; but we have more substantial faith in the business than outside persons who bought concessions, and then because the gold mine was not in sight immediately, abandoned their undertaking, not perhaps so much in despair as in want of patience. We have had our disappointments, but we feel decidedly encouraged to persevere by the success attending our efforts, by the progress opened out, by the estimates we are asked to give, and by the orders we have to fill. We were most anxious that none of our sub-companies should come to grief, and so, after an anxious consultation with the managers of those companies, we came to the conclusion that we had better unite, taking over the assets as going concerns, and go forward on the foundation they had laid. We knew that with our practical staff, and with the practical experience which we are gaining every day, that we should be able to extend the work in Birmingham and Yorkshire if this scheme were adhered to, because it was felt that some of the sub-companies had not money enough at their disposal to carry out their work properly. We found, too, that the Ferranti dynamos were admirably adapted for incandescent lighting; and in our efforts to solve the economic problem, and looking forward to seeing how to reduce the first cost of electric lighting, we considered it would be cheaper and better for us to acquire their manufactory, and have the manufacture of those dynamos entirely under our own control, and thus be in a position to supply the goods direct. Well, gentlemen, you will now be glad to hear Mr. Hammond speak upon the resolutions before you. I am now going to propose the first resolution, and I will ask Mr. Hammond to second it.

Mr. Robert Hammond, in seconding, said they must all feel that an amalgamation of the companies was a desirable thing to see accomplished. On the one hand they had the public anxious for the electric light—he said those words advisedly, because he believed them to be true. If they thought for a moment they could think of many cases in which it had been decided that the

electric light was far superior to any other illuminant. Away at the Savoy Theatre, for instance. Every one who went there came away satisfied with the light, and pleased that they had not been compelled to breathe vitiated atmosphere. They could also by means of the light eat in more comfort, because as they got their meals they did not take in any proportion of diluted chemicals. No doubt there were many theatres in the country which were waiting to follow the Savoy, and would take the light if it could be supplied to them. The First Avenue Hotel, in Holborn, which would be opened in about 14 days, would be lit to the extent of 1,200 lights by the Hammond Company. And if they went on to the factories in the land, the great advantages of the electric light were being more and more recognised. The light was safe, and was the only light that could be used where inflammable materials were present; and it was also the means of the production of better articles, for by reason of the better health of the *employés* their skilled labour correspondingly improved. He thought there was a great future for the light in the collieries, where serious accidents were occurring daily for want of more perfect lighting. And in railway carriages, too, how desirable was it, to many of them who spent so much of their lives in travelling. So that, altogether, they regarded it that the public were anxious to have the light, and they felt justified in doing so. On the other hand, they had lots of companies who had one object in view, really only that of supplying the light, and a certain number of companies all desiring to give the public the light, but all desiring to do so in a different way. It must be evident that since their object was similar, they could do great good by adopting some suitable means. While they were offering to give the light in a different manner from Swan and others, people were saying, "We will wait a little while until you have made up your minds *how* we are to get it." The public had justice on their side when they said that. Their directors would endeavour to overcome that anomaly, and strive for one comprehensive company to deal with the immense amount of electric lighting which had yet to be done, and done in a very short time. With this object in view, the resolutions were put before the shareholders that morning. He might say, in parenthesis, that, feeling that every effort should be devoted to striving for that object, the directors had made a settlement with the Brush Corporation. That dispute which had been pending over a year was now settled. (Hear, hear.) He thought the shareholders would feel that the directors had been most anxious to guard their interests, and to move towards the goal they had set before them, in the best manner possible. In view of the fact that the agreements with the Brush are not actually signed, they would not expect him to go into them in detail. But Mr. Sellon had said that an arrangement honourable to both parties had been made, on a perfectly equitable basis, considering the rights of both parties to the dispute. And the details of the proposed amalgamation were before them that day. His contention was that amalgamation of the companies was desirable, and therefore the board thought that the two companies which were offshoots from their own should have all the benefit which the Hammond Company could give them. He did not say one word against the directors of the Birmingham and Warwickshire Company. He believed they had worked as hard as possible to make the company a success. But unfortunately there was no knowledge of electricity on the board; they always came to the Hammond Company for advice, and after sitting on the board of that company for a short time he began to urge the question of amalgamation of it with the Hammond Company, and the result of their exertions had been the amalgamation of the two companies. He had just been to the meeting of the Warwickshire Company, and they were pledged to carry out the amalgamation if the shareholders of the Hammond Company agreed to it. Though they were issuing to the company a certain number of the Hammond shares and were taking no money, they got the solid assets of that company. They had £9,000 on deposit at the bank; and looking at it from the point of view of being anxious to store bigger amounts as the backbone of the Hammond Company, they had thought there was something very desirable in this amalgamation. The meeting was unfortunately held on Saturday, because that was the last day the agreements permitted for the holding of a confirmatory meeting. If they had not had it that day it would have jeopardised the whole thing. The remarks that he had been making with regard to the Birmingham and Warwickshire Company applied almost entirely to the Yorkshire Company. In his recent visits to Middlesborough he had been pleased to find a solid organisation on foot, where they worked night and day all the year round. If they amalgamated they took over all these arrangements. With regard to the Ferranti machine, they looked upon the taking over of this as a momentous question, and one upon which the future of the company largely hinged. The Hammond Company at their last meeting were agents for the Ferranti machine, but it had now become evident that the electric company which was going to live must be an electric lighting company with works at its command. When a man had made up his mind that he would have that light, he did not go about to get one portion of the work at one place and another at another. He would say, "You must be able to do the whole thing." And their Board felt that if they were to be an electrical company they desired to have the whole apparatus at their fingers' ends. They felt that it was better to have works of their own rather than go over the way for goods and pay 50 per cent. profit upon them. £36,000 in sovereigns was subscribed and put into the Ferranti Company twelve months ago, and had been very well used in that company. The bulk of that money went in the formation of works, which had been highly complimented by Sir William Thomson, to whom they were paying a royalty for the machine. He did not mind paying that, because it assured them his advice at any time when ever they wanted it. In the first place they got the works, and when they got the works they felt that they could make anything. They were not bound for all time to make these particular machines. But it was well known that the Ferranti machine was suitable to apply to any purpose of the company. Against that £36,000 in cash that came into that business, the directors of the Hammond Company said, "We are willing to give 36,000 ordinary shares in our company," and he felt a more honest bargain had not been made between two companies. That really covered the question of works. Then they had to deal with certain gentlemen who had not formed part of those who put in the £36,000—the patentees. To the patentees they said, "We will also be willing, if you will turn over to the Hammond Company the patents of the Ferranti machine, to give you a deferred interest in the Hammond Company. You shall not rank side by side with the money which had been put into the Hammond Company, but when the whole of the capital of the Hammond Company has paid 5 per cent. then you shall be entitled to participate." And it had been proposed that the matter of £80,000 should be issued in deferred shares to the Ferranti Company on the terms he had named. He dwelt upon that because it had been said by some that the Hammond Company's directors were going along very fast, and were watering the stock. That could not be said, for the whole bargain was one under which, though they had issued more shares, they got such solid assets for their shares that they would be able to increase the earning power through the consolidation. They paid £80,000 in deferred shares to the patentees of the Ferranti machine. "We do not hear much of the Ferranti machine," some say. "What are you going to get for it? We want to know what you are really going to do." With regard to the Brush arc machine, it would be used by the company for all arc lighting purposes. In their central station at Brighton they were using the Brush arc lamps. On the other hand they had felt, and they felt it now, and he did not mind saying so, that the Brush Company were deficient in what was most important, an incandescent machine. It must be a machine that would work an immense district. A house to house lighting machine would be the only one that would do in the future. How often were they told, "If you can put the electric light into my house as you put in gas, I will pay you three times as much for it?" The Hammond Company agreed to work the arc light well and thoroughly, but they very much felt that for the large incandescent lighting, which was immediately coming upon them, they wanted a machine not only capable of running 1,000 lights, but they hoped to tell them that they had one capable of running 10,000 lights, and that was in the Ferranti machine. He had heard gentlemen disparage the Ferranti machine, and he went home feeling sad the other night to know that there was one gentleman in London who thought there was not a successful installation of the Ferranti machine anywhere. He (Mr. Hammond) had the Ferranti machine at work at his home at Highgate every night, and he should always be willing to take any opponent home with him just by chance to see the light at work. The payment to the Ferranti Company of £36,000 in ordinary shares to cover the £36,000 in sovereigns was well considered. They had thought the arrangement satisfactory. As a shareholder in both companies, he felt it was very satisfactory himself. The Ferranti machine had shown its capability of coping with the problem of the immediate future—the house to house lighting by means of electricity. In the course of fourteen days the shareholders would be able to see at the First Avenue Hotel the largest installation in the world, which would be done by the Hammond Company. They had been asked, "Why don't you come here and light my place the same as I do by gas?" But they should remember that the sum invested in the development of electric lighting was a mere trifle compared with the millions invested in the gas interest in the country. Was it to be expected that the comparative trifle invested in electric lighting would be able to cope with the immense sums invested in the gas interest? When the public had determined that the electric lighting could be done on an economical basis, then they would agree to persuade Town Councils to take up the question, and have the control over the matter themselves. It would not be expected that any electric lighting company would go, say to Brighton, and sink £30,000 or £40,000 in installations and then find themselves without capital to do other work. In Brighton they had decided to spend £60,000 in electric lighting, and this company would have an interest in doing a portion of the work which that £60,000 covered. The first piece of lighting there would be put into the hands of this company. He felt that towns generally were gradually making up their minds to have the light; and if so, it must be supplied from a large centre, and big engines and big dynamos would be needed for distribution of the current over a large area, just as they carried gas through the pipes for long distances. The nearer they got to solving that problem the nearer they got to the application of the electric light all over the kingdom; and such companies as theirs would be able to cope with the business as that came along. The only company that was likely to cope with that work was the Hammond Company, if the resolutions before the shareholders were agreed to.

A shareholder: What are the assets of the sub-companies?

Mr. Hammond explained that the total assets of the Birmingham and Warwickshire Company might be set down at £12,000, and its liabilities at £2,300, including a debt of £1,000 to the Hammond Company, which would be simply moved from one company to the

other. The net amount of assets was £9,700. There was an installation in Warwickshire payable over seven years, with some solid people. The Yorkshire Company was set down in the amalgamation arrangements as having assets of £15,600. There was an amount there, £5,400, for a machinery already put up, and there was also included the Middlesborough station, which was earning money, which he was confident it would continue to do. The Middlesborough Town Council were purveyors of gas, but there was a little spot, where their electric works were erected, over which the Corporation had no control, and where the company now had a chance of increasing their work. He believed the Middlesborough installation was one which might at any moment be turned into cash by the Town Council purchasing it. Every bit of machinery sold to the Yorkshire Company had been taken back by the Brush Company. The total assets of the company were £17,000; liabilities, £1,398; net balance, £15,600. "But," some one might say, "they are getting in return £22,400 in shares of the Hammond Company." The Hammond Company sold the concession to the Yorkshire, and they got back the solid assets. It was an advantage to the Hammond Company of £7,000 to be able to re-enter the electric lighting field of Yorkshire. The liabilities of the Ferranti Company were practically *nil*. The Hammond owed them money for the machine going to the Grand Hotel. The premises of the Ferranti Company were only on rental, so that they could move away at any time. One machine running 3,000 lights was among the assets.

Mr. Harley asked if any sum of money had been set on one side to meet the claim of Mr. Liardt and others against the Hammond Company?

The Chairman: That has nothing to do with these resolutions. We don't admit any claim. We claim that he owes us money.

Mr. Harley contended that it had something to do with the state of the company's funds.

The Chairman: I see you have only one share in this company, and we can pretty well guess how you got it. (Cries of "sit down.") The question has been fully answered, and the feeling of the meeting is that you should sit down.

The resolutions, as printed in the ELECTRICAL REVIEW of November 10th, were then put by the chairman, and formally seconded by Mr. Hammond, Mr. Harley being the only dissentient.

The Chairman explained that the last time they met there they were endeavouring to stop litigation with the Brush Company. They had had a good deal of negotiations, but they had been able now to carry out an arrangement honourable and equitable, which swept difficulties out of the way of both companies. The only action now in existence was the one Mr. Harley had referred to, and that they did not admit.

A vote of thanks to the chairman closed the proceedings.

The Eastern Extension, Australasia and China Telegraph Company, Limited.

THE twentieth ordinary general meeting of the shareholders was held at the Cannon Street Hotel on Wednesday, Mr. John Pender, M.P., the chairman of the company, presiding.

The Secretary, Mr. F. E. Hesse, read the notice convening the meeting, and the directors' report, which we published in our last issue, was taken as read.

The Chairman said before entering upon the few general remarks he had to make he would give them a summary of the receipts and expenses during the last six months. The gross receipts for the half-year amounted to £213,729, and for the corresponding period of 1882 to £207,119, or an increase of £6,610. The working expenses were £62,778, and in the corresponding period of last year £50,355, an increase of £12,423. That was principally accounted for by the ship expenses, which included the cost of the *Sherard Osborn* for the whole of the six months, rendering assistance to the contractors in the China waters in laying the shore ends and river portions of the cables between Hongkong, Foochow and Shanghai—an increase of £6,200—and station expenses, which included the expenses of the new China stations from January last, although the cables were not opened until the close of the half-year—an increase of £4,338. The expenses of the new issue of the capital absorbed over £1,000. The net revenue for the half-year amounted to £107,356, as against £113,393 for the corresponding period of 1882, showing a decrease of £6,037, which was explained by the abnormal expenditure he had referred to. The dividends and bonuses on the old and new shares to the 30th June which had been distributed amounted to £75,000, and of that amount £59,925 was paid on the old capital and £15,075 on the new issue. The balance carried over to the next account was £32,356, against £23,468 for the corresponding half-year of 1882. Although the new China cables were laid in the early part of the year, the opening of the lines, owing to the many difficulties raised by the Chinese authorities, was delayed several months, during which time more than normal expenses, under ordinary circumstances were necessarily incurred without a corresponding return. At their last meeting he gave them a full description of their negotiations with China—their reasons for having established their headquarters at Shanghai—and the opening of the connection with China had been upon the whole a very successful movement. The Chinese were a very intelligent, far-seeing people. They were not particularly anxious to have the European element much amongst them, but it was found that, when they went into direct negotiations with them, they were amenable to reason, and the result had been that in their steadily keeping their views—the carrying out of which they believed would benefit the Chinese as well as themselves—steadily before them, they had been successful, he thought, in establishing what must eventually be productive of very great benefit to this country. China was beginning to adopt European notions of trade, and he believed that before long they would have their traffic with China largely increased, particularly through telegraphic communication, because the telegraph had now become one of the most important agents in commerce. They heard a great deal every day now about what the Suez Canal had done for the commercial interests of the country, but they might shut up the Suez Canal to-morrow without commerce feeling any great inconvenience (question), but if they were to shut up the telegraphic system, they would so convulse commerce that it would be impossible for a very considerable time to bring it back to its ordinary channels. During the six months they had rather an important break, namely, of their cable betwixt Madras and Penang. It broke during the monsoon, and at one time a break during the monsoon would have been considered almost an impossibility to repair. That cable, however, was successfully repaired during the monsoon, thus giving them additional confidence in submarine telegraphy. One of the Java and Darwin cables broke. In repairing it they broke the other, and it so happened that they picked up the end of the one and the end of the other and spliced them together, and thus proved that even when one half of one cable was spliced to the half of another they would work. The Australian people, who appreciated immensely the importance of the submarine cable, were about to hold a conference as to how far it was possible for them to reduce their rates. Whenever they could see that commerce was to be promoted—that the reduction of rates was to increase traffic—they were ready to concede to that reduction, but they had at the same time stated their opinion that the speculation must rest with the colonies and not with them. If the colonies secured to them something like what they were earning at the present moment, they would be quite prepared to make such arrangements as would enable them to considerably reduce the rates. In commerce so it was in politics, and they were now, he hoped, likely to carry out a successful negotiation with the French Government to connect their interests in China with their main system. He hoped they should be able to announce shortly that they had completed an agreement with the French Government to connect Saigon with Tonquin. They were replacing a good deal of their cable, which had been more or less injured by the earthquake at Java. By that earthquake, which destroyed a very great extent of country, their loss would only amount to £100 or £150. The Dutch Government had suffered to some extent, and they had completed a contract with them for replacing their cable. Looking to the small loss they had sustained by the earthquake, and the amount of suffering incurred by it, they had contributed £250 on behalf of the sufferers. (Hear, hear.) He moved that the report and accounts be adopted.

The Marquis of Tweeddale seconded.

Mr. Barham said the report stated that, after somewhat protracted negotiations with the Chinese Government, the new China cable between Hongkong and Shanghai was opened for traffic on the 22nd May last, but the chairman had not explained what those negotiations were. Neither had they had an explanation of the general expenses in London. They had gone up something like 20 per cent. That seemed to be rather a large increase. The directors' remuneration had been increased by about 25 per cent., and the auditors' remuneration had also been added to.

The Chairman replied that, as to the directors' fees, he was afraid Mr. Barham was not present at their last meeting, or he would have found that he (the chairman) was perfectly straightforward with the shareholders. He then stated that for a time the directors had reduced their fees by about £1,000, and that they thought the time had come when they were entitled to return to the old amount. The auditors' remuneration was also increased, and that of the staff. In regard to the increase generally for the last half-year, they had been paying money upon capital which had not come fully into play. Mr. Barham had asked him to explain their negotiations with the Chinese Government, but he did not think it would be right of him to tell about a half-finished contract. The shareholders must trust the directors, and if they made a bad bargain they were there to justify themselves. They were negotiating now for connecting Saigon with Tonquin. What the result of that negotiation would be he was not yet prepared to say. They had got their cable landed at Keisong and Foochow, and he expected by that time also at Hongkong. They had done as much as he had foreshadowed.

In answer to Mr. Newton, who complimented the directors on the management of the business of the company,

The Chairman said he did not think the war in China would do them much harm. The Press showed a wonderful amount of enterprise. He had known some of the penny papers pay as much as £500 for a message from China to this country, and they might depend upon it they would do the same again, such was the desire to have information. When the war was over they expected an enormous increase.

A vote of thanks to the chairman and directors closed the meeting.

The India Rubber, Gutta Percha, and Telegraph Works Company, Limited.—A circular has been issued by the secretary (Mr. W. J. Tyler) to the shareholders, stating that, considering the varied nature of their operations—which might include branches of industry connected with electricity and similar forces, but not strictly telegraphic—and the increasing

importance of their business abroad, the directors deem it advisable to apply to Parliament for a short Act to make the company's memorandum of association clearer and more comprehensive. In due time a meeting of the shareholders will be called, when the Bill will be submitted for their approval.

LATEST QUOTATIONS.

Authorised Issue.	Share.	Name.	Paid.	Closing Quotations, Nov. 14.	Business Done.
		ELECTRIC LIGHT.			
40,000	10	Anglo-American Brush Co.	8	2½ - 2¾	2⅝.
..	..	Do.	10	4½ - 5	
30,000	5	Australasian E. L., Power & Storage Co.	3	⅜ - ½	
24,000	10	British Insulite Co., Ld., "A" Shares..	5	1 - 2	
30,000	5	Brush Elec. Lt. & Power Co. (Scotland)	2½	¼ - ⅜	
25,000	5	Gt. Western Electric Light & Power Co.	2½	¼ - ⅜	
24,080	5	Hammond Elec. Lt. & Power Sply. Co.	3½	2¼ - 2⅝	
40,000	5	Indian & Ori. Electl. Storage Wks. Co.	2	..	
197,500	1	Maxim-Weston Elec. Lt. & Power Co. ..	1	¼ - ⅜	
..	..	Metrop. Brush Electric Lt. & Power Co.	5	..	
40,000	5	Pilsen-Joel & Gen. Elec. Lt. Co.	2½	..	
..	..	S. African Brush Elec. Lt. & Power Co.	2½	..	
100,000	5	Swan United Electric Light Co., Ld.	2½	1⅛ - 1¼	1 7/16.
		TELEGRAPHS.			
1,892,480*l.*	Stk.	Anglo-American, Limited	100	41½ - 42¼	43-2½-½.
2,553,760*l.*	Stk.	Do. Pref. } Def. receiving no div. until	100	71 - 72	72⅞-73-2-½.
2,553,760*l.*	Stk.	Do. Def. } 6 p. c. paid to Pref.	100	12¾ - 13½	
130,000	10	Brazilian Submarine, Limited	10	9½ - 9⅝	9½-7/16-xd.
16,000	10	Cuba, Limited	10	10¾ - 11	
6,000	10	Do. 10 per cent. Preference ..	10	17½ - 18½	
13,000	10	Direct Spanish, Limited	9	4½ - 5¼	
6,000	10	Do. 10 per cent. Preference ..	10	13½ - 15½	
65,000	20	Direct United States Cable, Ld., 1877 ..	20	10½ - 10¾	10 7/16-½.
100,000*l.*	100	Do. 6 per cent. Deb., repayable 1884	100	98 -101	
380,000	10	Eastern, Limited	10	10¼ - 10⅝	10 1/16.
70,000	10	Do. 6 per cent. Preference	10	13 - 13½	
232,000*l.*	100	Do. 6 do. Debs., repayable Oct. 1883	100	..	
200,000*l.*	100	Do. 5 do. do. Aug. 1887	100	102-104	
200,000*l.*	100	Do. 5 do. do. Aug. 1899	100	104-108	
250,000	10	Eastern Exten., Australasia & China, L.	10	11¼ - 11⅜	11¼.
320,000	100	Do. 6 p. c. Debs., repayable Feb. 1891	100	107 - 110	
500,000	100	Do. 5 p. c. (Aus. Gov. Sub.) Deb. 1900	100	102 - 106	
140,000	100	Do. do. reg., repayable 1900..	100	103 - 107	
100,000*l.*	100	Do. 5 per cent. Debenture, 1890	100	101 - 104	
254,300*l.*	100	{ Eastern & South African, Ld., 5 p. c. } { Mort. Deb. Rg. redeemable 1 Jan. 1900 }	100	102 - 105	
345,760*l.*	100	Do. do. do. To Bearer.	100	102 - 105	
22,050	10	German Union Telegraph & Trust, Ld.	10	10¼ - 10½	
250,000	10	Globe Telegraph & Trust, Ld.	10	6½ - 6¾	6¾-½.
250,000	10	Do. 6 per cent. Preference ..	10	12½ - 13½	12½-13-12½/16
150,000	10	Great Northern	10	12⅝ - 13⅛	13⅛.
100,000*l.*	100	Do. 5 per cent. Debentures ..	100	100 -103	
300,000	100	Do. 5 per cent. Debentures ..	100	101 -103	102½.
81,200	10	India-Rubber, Gutta-Percha, & Tel. Wks.	10	30 - 31	
100,000	100	Do. 6 per cent. Debs., 1886	100	102 -105	
17,000	25	Indo-European, Limited	25	31 - 32	
38,348	10	London Platino-Brazilian, Limited	10	3½ - 4	
12,000	10	Mediterranean Extension, Limited	10	1¼ - 1½	
3,200	10	Do. 8 per cent. Preference	10	2 - 4	
9,000	8	Reuter's, Limited	8	8½ - 9	
338,225	Stk.	Submarine	100	200 -210	204½.
58,225	1	Do. Scrip	1	1¼ - 2⅛	1 1/16-2.
4,200	Cert.	Submarine Cables Trust	100	102 -105	
27,350	12	Telegraph Construction and Mainten.	12	35 - 36	
150,000	100	Do. 6 per cent. Bonds, 1884 ..	100	101 -103	
186,750	5	Do. 2nd Bonus Trust Cert. ..	2½	1⅛ - 1⅜	
30,000	10	West Coast of America, Limited	10	4½ - 5½	
150,000	100	Do. 8 per cent. Debs.	100	106 -108	
45,791	20	Western and Brazilian, Limited	15	4⅝ - 5⅛	
24,119	..	Do. Preferred	7½	4 - 4½	
24,119	..	Do. Deferred	7½	¾ - 1	
200,000*l.*	100	Do. 6 p. c., Debs. "A" 1910 ..	100	102 -106	
250,000	100	Do. 6 p. c. Mort. Deb. B. '80, red. Feb. 1910	100	94 - 97	
1,500	$1,000	Western Union 7 p. c. 1 Mort. (Bg.) Bds.	$1,000	119 -121	
1,030,000*l.*	100	Do. 6 per cent. Sterling Bonds	100	100 -103	
88,321	10	West India and Panama, Limited	10	¾ - 1⅛	
34,563	10	Do. 6 per cent. 1st Preference	10	6½ - 7	
4,669	10	Do. 6 do. 2nd do. ..	10	4½ - 5	
		TELEPHONES.			
224,840	1	Con. Telc. & Mainten., L., Nos. to 154,165	1	⅛ - ¼	
225,000	1	Oriental Telc. Co., Nos. 80,001 to 300,000	1	⅛ - ¼	
100,000	5	United Telephone Co.	5	7⅛ - 7¼	7⅛-¾-¼.

MEETINGS OF SOCIETIES.

Physical Society, November 10th, 1883.

Prof. CLIFTON in the Chair.

DR. J. BLAIKLEY read a paper on the "Velocity of Sound in Air," in which he described a modification of Dulong's method of measuring it by the wave-length in a pipe lengthened. Dulong did not allow for the partial tones, which are an important factor, whereas Dr. Blaikley does. By means of organ pipes of different diameters the author has found the velocity to be about 320 metres per second. Mean result with four tubes:—one of 54·1 millimetres in diameter, velocity = 329·73 metres per second; one of 32·5 mm. diameter, velocity = 328·78 metres; one of 19·5 mm. diameter, velocity = 326·9 metres; one of 11·7 mm., velocity = 324·56 metres. The velocity diminishes as the tube is smaller in bore.

Mr. BOSANQUET made a communication "On the Moment of a Compound Magnet," which he showed how to measure by the method already published by him.

A compound magnet made up of 18 small cylinders of magnetised steel, placed end to end, is hung in a cradle, carried by a delicate bifilar suspension, and placed at right angles to the magnetic meridian. The deviation from zero produced from the magnet is noted; then the magnet is divided into two parallel rows of nine cylinders along the cradle, and the deviation again noted. The tangent of the angle of deviation from the east and west line, multiplied by a constant, is the moment of the magnet. The author also pointed out that to define the condition of a permanent magnet it was necessary to know the difference of magnetic potential, the "resistance" of the metal, and the resistance of the external space.

Mr. W. LANT CARPENTER read a paper "On Measurements relating to the Electric Resistance of the Skin, and certain Medico Appliances." The author's experiments, made upon himself, showed that the resistance of the body amounts to thousands of ohms, but is mainly due to the condition of the epidermis. If this is dry the resistance is high. By soaking the skin in salt and water he reduced the resistance of parts of his body from 10,300 ohms to 935 ohms after 100 minutes' soaking. He infers that a large electrode should be used in applying electricity to the body, and that the skin should be soaked for 25 minutes previously. Mr. Carpenter also exhibited a "chain band" by Mr. Pulvermacher, and a small voltameter by the same inventor, in which the liberated gases force some of the water up a graduated tube as a gauge of the current. The author drew attention to the necessity of seeing that the skin should be dry in handling some electric light machines, else disagreeable shocks might result.

Prof. AYRTON believed that the danger of electric lighting currents lay rather in their discontinuity than their electromotive force. The Brush currents which have proved fatal are more discontinuous than those of the Gramme machine, &c. Adverting to the presence of electricity in the air as influencing health, he suggested that the influence might be studied by electrifying the air—say, in a hospital ward.

Mr. W. COFFIN stated that statically electrifying patients had been tried at Bellevue Hospital, New York, without definite results.

The Society of Telegraph Engineers and Electricians.

THE first ordinary general meeting of this society for the winter session, was held on November 7th, Mr. WILLOUGHBY SMITH, President, in the chair. The minutes of the last ordinary general meeting having been read and confirmed and the list of new, and proposed new, members read, the president vacated the chair, which was then taken by Prof. W. G. ADAMS. A paper was then read by the PRESIDENT on "Volta Induction." The substance of this paper, which was illustrated by experiments, was similar to that contained in the inaugural address, published (with full illustrations) in the number of the ELECTRICAL REVIEW for Jan. 27th. In conclusion, Mr. Willoughby Smith said: "I would ask, what can we as practical men gather from these experiments. A great deal has been written and said as to the best means to secure conductors carrying currents of very low tension, such as telephone circuits, from being influenced by induction from conductors in their immediate vicinity employed in carrying currents of comparatively very high tension, such as the ordinary telegraph wires. Covering the insulated wires with one or other of the various metals has not only been suggested, but said to have been actually employed with marked success. Now, it will be found that a thin sheet of any known metal will in no appreciable way interrupt the inductive lines of force passing between two flat spirals; that being so, it is difficult to understand how inductive effects are influenced by a metal covering, as described.

Telegraph engineers and electricians have done much towards accomplishing the successful working of our present railway system, but still there is much scope for improvements in the signalling arrangements. In foggy weather the system now adopted is comparatively useless, and resource has to be had at such times to the dangerous and somewhat clumsy method of signalling by means of detonating charges placed upon the rails. Now, it has occurred to me, that volta induction might be employed with advantage in various ways for signalling purposes. For example, one or more wire spirals could be fixed between the rails at any convenient distance from the signalling station, so that when necessary, intermittent currents could be sent through the spirals; and another spiral could be fixed beneath the engine or guard's van and connected to one or more telephones placed near those in charge of the train. Then, as the train passed over the fixed spiral, the sound given out by the transmitter would be loudly reproduced by the telephone and indicate by its character the signal intended. One of my experiments in this direction will, perhaps, better illustrate my meaning. The large spiral was connected in circuit with 12 Leclanché cells and the two make and break transmitters before described. They were so connected that either transmitter could be switched into circuit when required, and this I considered the signalling station. This small spiral was so arranged that it passed in front of the large one at the distance of 8 inches and at a speed of 28 miles per hour. The terminals of the small spiral were connected to a telephone fixed in a distant room, the result being that the sound reproduced from either transmitter could be clearly heard and recognised every time the spirals passed each other. With a knowledge of this fact, I think it will be readily understood how a cheap and efficient adjunct to the present system of railway signalling could be obtained by such means as I have ventured to bring to your notice this evening." In the discussion which followed the reading of the paper, Prof. Adams, Prof. Hughes, Mr. A. J. S. Adams, Mr. Preece, Prof. Ayrton, Col. Malcolm and Mr. C. E. Spagnoletti took part. The meeting then adjourned.

NEW PATENTS—1883.

5272. "Machines and apparatus employed in the production, regulation and utilisation of electric and magnetic forces." J. S. FAIRFAX. Dated November 7.

5293. "Commutators or collectors of electrical machines." J. H. JOHNSON. (Communicated by Z. T. Gramme.) Dated November 8.

5299. "Electric arc lamps." A. SPRINGMANN. (Communicated by H. A. Earle and E. Goltstein.) Dated November 9.

5325. "Carbons for incandescent electric lamps." J. WAVISH, J. WARNER, M. BAILEY. Dated November 10.

5338. "Automatic electric copying and engraving machines." J. WETTER. (Communicated by A. Schmid.) Dated November 12.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1883.

1122. "Secondary batteries or accumulators." D. G. FITZ-GERALD. Dated March 1. 6d. Relates to improvements in secondary batteries or accumulators, and consists in the manufacture of indestructible electrodes, or of electrodes which will last for an indefinite period, by the use of any suitable impervious and insulating materials with which the electrode or the supporting plate backing is in part coated, prepared, or saturated.

1127. "Insulating wires for electrical purposes." W. A. PHILLIPS. Dated March 2. 2d. The object of this invention is an improved method of covering or coating wire with an insulating material of strip form laid longitudinally and the seam secured by heat or other means, said covered or coated wire being then encased in the same or other material by braiding or otherwise. (*Provisional only.*)

1139. "Apparatus for indicating, controlling, and regulating the flow of electric currents for lighting, &c." P. R. ALLEN, Dated March 2. 6d. The invention relates to a method of indicating in the central station the extinction of any lamps upon the circuit, or the closing of any switches, or alteration of translating devices which may be operated in the main circuit.

1156. "Electric incandescence lamps." A. M. CLARK. (Communicated from abroad by J. M. A. Gerard-Lescuyer, of Paris.) Dated March 3. 2d. Relates to improvements in electric incandescence lamps, and it consists in the arrangement and combination of a pair of straight or curved fine pencils, or of carbon pressed at their free ends against a block of carbon placed between them or against one another, so as to effect a certain and renewable contact in case of wear, and in the means of supporting or fixing the carbons in this position, and also in the support for the bulb or envelope in which the lamp is enclosed. (*Provisional only.*)

1171. "Electric lamps or lighting apparatus." H. H. LAKE. (Communicated from abroad by E. Weston, of America.) Dated March 5. 2d. Relates more particularly to clutch or clamp lamps, that is to say, lamps in which gripping mechanism for the carbon-holder is employed in conjunction with a suitable system of electro-magnets, and it consists mainly in improvements in the character and disposition of the magnets and armatures, whereby a better and cheaper lamp than those heretofore made may be produced. (*Provisional only.*)

1182. "Electric arc lamps." J. E. L. CLARK, W. J. K. CLARK, and R. D. BOWMAN. Dated March 5. 8d. Relates to improvements in electric arc lamps, and consists, first, of improved means for regulating the feed of the carbons, and, secondly, of means for varying the length of the arc to suit currents of different intensity.

1184. "Apparatus for regulating the speed of engines used for driving dynamo machines for electric lighting, &c." P. W. WILLANS. Dated March 5. 6d. Has for its object the better regulation of the speed of engines driving dynamo machines, so as in the case of electric lighting to ensure as far as possible the maintenance of a constant current in the lamps, independent of the number of lamps burning, or of the pressure of steam, or of other outside causes.

1190. "Secondary or storage batteries." T. ROWAN. Dated March 6. 6d. Relates to further improvements in that class of secondary or storage batteries for which provisional protection was granted No. 791, dated 13th February, 1883.

1197. "Secondary piles or batteries or accumulators of electricity." E. G. BREWER. (Communicated from abroad by E. Pfeifer of Antwerp.) Dated March 6. 2d. The new pile is obtained by the employment of spongy lead, obtained electrolytically or by chemical precipitation. (*Provisional only.*)

1198. "Dynamo-electric machines." C. LEVER. Dated March 6. 6d. Has for its object improvements in dynamo-electric machines or machines which convert mechanical energy into electric currents. Relates to a method of obviating the use of the commutator, and its essential feature consists in keeping both the field-magnets and the armature fixed. Instead of revolving the armature or the field-magnets, the inventor passes through one or both poles of the field-magnet or magnets, a rod of magnetisable or paramagnetic metal, preferably iron or steel, and which can revolve freely through the said field-magnet pole or poles. Attached to this iron or steel rod, or forged thereon, is a plate, cylinder, or ring of iron, which can revolve with the said rod, and which becomes polarised or magnetised from the pole-piece of the field-magnet. The rod or bar of iron or steel which passes through the pole of the field-magnet carries a pulley at the end opposite to the said plate, cylinder, or ring of iron, so that when the pulley is turned the whole revolve together, and therefore when the field-magnet is energised the said plate, cylinder, or ring of iron or steel will be polarised or magnetised as it revolves.

1202. "Electric arc lamps." E. JONES and A. E. JONES. Dated March 6. 1s. Relates to improvements in electric arc lamps, and consists of means for ensuring the steady, gradual feed of the carbons without breaking circuit, and for preventing the sudden extinction of one lamp in a circuit from interfering with and extinguishing or destroying the other lamps in that circuit.

1208. "Galvanic batteries, &c." T. SLATER. Dated March 6. 4d. Has for its object improvements in galvanic batteries, and means employed in storing or accumulating electrical energy. In carrying out the invention the inventor forms the electrolyte, or cathode of a galvanic battery, or a battery for storing or accumulating electrical energy, of the following materials, that is to say, quick lime (say 1 lb.), slacked by pouring thereon a saturated solution of bichromate of potash. To this lime so slacked is added, little by little, nitrous or nitric acid, of about the ordinary commercial strength (say 6 lbs.), or instead of the nitrous or nitric acid a saturated solution of nitrate of soda or of nitrate of potash may be employed in equivalent quantity, which quantity would be about three times greater in the latter instance than in the former one, covering the vessel containing the same until the fumes evolved have subsided. In another vessel is placed caustic soda or caustic potash (say 4 lbs.) and water (say 4 quarts), to which is added dry sawdust (say 2 lbs.) of beech, fir, or other suitable wood, sawdust or other suitable form of cellulose, and this is left to macerate until the sawdust or other cellulose becomes a pulpy mass. The inventor then mixes this last with the lime, nitric, or nitrous acid, and bichromate of potash, and when these have thoroughly mixed he adds chloride of sodium (say 1 lb.), and after the mixture has been allowed to stand for a few hours it may be placed in the desired receptacle in contact with the elementary metal or other suitable substance constituting the one pole of the battery. This substance may be a strip or strips or other form of carbon, or wrought iron or other suitable metal, kept in position or supported by connecting strips or bands, or otherwise. This pole and electrolyte may be separated from the other pole of the battery by a porous diaphragm or other suitable means of separation. Within the porous vessel, as the opposite pole or electrode of the battery to that first described, is placed a plate, cylinder, or other suitable form of metal, for instance zinc, or a suitable metal coated with zinc, may be used, and this electrode is excited by placing in the vessel a mixture of caustic soda or caustic potash, chloride of sodium, muriate of ammonia, and muriate of zinc, in proportions sufficient to form a neutral or saturated solution, or in proportions such as will give a reguline deposit of zinc during electrolysis.

1218. "Electro-magnetic signal apparatus for railways, &c." F. J. DREWRY. (Communicated by J. D. Gould, B. M. Plumb, and G. W. Daniels, of America.) Dated March 7. 1s. This invention, relating to railway signals, is embodied in a railway signal apparatus of that class in which the signal is normally held concealed, or indicating safety by the attraction of an electro-magnet in a normally closed electric circuit, the said signal being actuated by some force, preferably gravity, when the said magnet is demagnetised and falling into position to be viewed by the engineer of an approaching train, it then indicating danger, and the engine drivers being instructed not to pass a point at which one of the said signals is displayed.

1238. "Telephonic apparatus." SILVANUS P. THOMPSON. Dated March 7. 8d. Relates to the apparatus described in the number of the ELECTRICAL REVIEW for November 3, 1883.

1240. "Electrical induction apparatus." E. EDWARDS. (A communication from abroad by G. Babillot, of France.) Dated March 7. 4d. Relates to a novel method of construction and arrangement of electrical induction apparatus, in which currents of electricity are generated by induction, the electro-magnets by which such currents are generated being excited automatically by the induced currents. (*Provisional only.*)

1255. "Electric lamps and fittings therefor." J. G. STATTER. Dated March 8. 8d. Relates to improvements in electric lamps and fittings therefor, the object of the invention being to insure in a better manner than hitherto the gradual feeding of the carbons in arc lamps, as they are consumed without serious intermittence or irregularity, to allow the lamp to be automatically cut out of circuit when the carbons are consumed or become fixed, and to allow of extinguishing any lamp or lamps out of a number without interrupting the main current. The improvements also relate to an improved carbon holder for arc lamps, and to improvements in adapting existing gas fittings for electric light fittings, and to an improved holder for incandescent lamps.

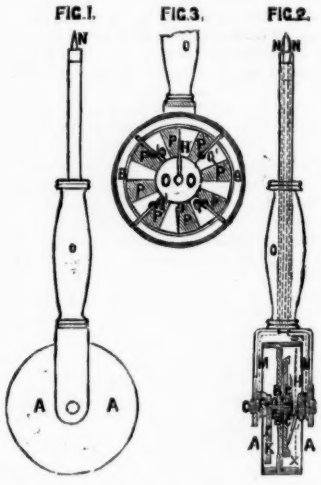
1258. "Electrical signalling apparatus." W. J. BREWER. Dated March 8. 6d. Relates to signalling apparatus operated by electricity, and is designed to give audible notice to the engine-driver of the position of the ordinary semaphore or other signals,

and to give audible or visible indication to the signalman of the passage of the trains.

1275. "Electric lamps." J. S. KELSO. Dated March 9. 2d. Relates to improvements in the manufacture of that class of electric lamps in which an electric current is caused to pass through and heat a carbon fibre or filament forming part of the circuit, and which carbon fibre or filament is inclosed in a glass tube or globe, from which the air is exhausted, so as to form a vacuum, or the tube or globe is filled with an artificial atmosphere. The invention consists in arranging two or more carbon fibres or filaments, or their equivalents, upon a support, either divided or insulated centrally. (*Provisional only.*)

1290. "Telephonic apparatus." G. H. BASSANO, A. E. SLATER, and F. T. HOLLINS. Dated March 10. 8d. Relates chiefly to telephone transmitters, and is a modification of Prof. Hughes' microphone with several novel arrangements and improvements. Under this invention it is proposed to use a diaphragm or tongue-sounding board of any resonant material, secured only at the bottom, or if a diaphragm is fixed in a horizontal position at one end, leaving the top or the other end and the sides unsecured so as to allow of its free vibration. An important part of this invention is that the pencils are used separately to form multiple microphonic primary circuits, each having a separate battery.

1295. "Electric apparatus for igniting inflammable gases, &c." A. R. MOLISON. Dated March 12. Consists of an improved apparatus for producing a spark of so called "static electricity" which is intended chiefly as an improved electric gas lighter, but which of course can be employed wherever an electric spark may be of use, such as for experimental electrolysis, firing fuses, and other kindred purposes. It consists of the employment of means for more effectually preventing the deposition of moisture from the air on the machine for producing the spark which is the well-known cause of both the ordinary frictional and statical induction machines failing to act in certain states of the atmosphere. It also relates to an improved construction of machine. The inventor employs for his purpose a modification of some of the



known forms of self-charging induction machines, by preference of that known as the "Voss." Fig. 1 is a view of a complete apparatus of the portable form. A, A is a circular box containing the generating apparatus. This box is provided with pivots and is free to rotate in bearings in the fork or holder which holds or supports it. Fig. 2 is a section of the box or case and contained apparatus, but shows in section only the lower part of fork with bearings. A, A is the case or box of suitable material, as before referred to, in two or more parts, fitting together in the usual fashion of box and lid or in any other suitable manner. When complete, the box is hermetically sealed by a layer of paraffine or beeswax, resin, cement or such like substance between the sliding parts of box and lid, or other modes of sealing may be adopted, such as soldering, &c., but the former is frequently found advantageous, or the case and lid may fit tightly, such as by screw or otherwise, which is, unless made air-tight by such means, a less perfect form. B, B and C, C are the plates of the generating apparatus, of a non-conducting substance. B, B is rigidly attached to the box at the circumference and has a hole at its centre. C, C is attached to the hollow axis or tube, D, which turns freely on the metallic rod or axis, E. This axis passes through the box or case in the insulating arrangement shown at F, or by other suitable means, and enters the bearing, G, also of insulating material, forming one of the pivots on which the box turns. This axis is in metallic connection with the collector, H, and thus acts as a conductor to carry the electricity to the outside of the box. The electricity from the collector, I, is carried in a similar manner to the other pivot. L is a nut to prevent C, C moving from its place. J is an arm attached to the hollow axis, having a weight attached at K. Fig. 3 is a section through X—Y. The lined sections, P, P, represent thin metallic plates (such as tinfoil) attached to the discs, C, C. These may be of any number. Q, Q^1, Q, Q^1 are four small brushes or pads of metallic tinsel or fine wire attached to four light springs. The springs press the brushes or pads lightly against the disc. Q^1 and Q^1 are attached to the side of the box, while Q and Q are in metallic contact with armatures fastened to the back of the plate, B, B. These armatures are not shown, as this part of the arrangement is similar to that of the well-known "Voss" machine. Referring back to fig. 2, the plates, B, B and C, C are shown recessed, this to obtain strength with lightness and thinness at the parts through which induction takes place. The armatures before referred to lie in the recess of B, B. The brushes or pads and springs are not shown in this section. The dotted lines, M, M, represent insulated wires carried from the pivots of the box to the points, N, N, at the top of the tube through which they are carried across which the sparks are discharged or pass. O is the handle or holder. The pivots of the box may turn directly without insulation in the prongs of the fork, in which case the fork forms part of the conductors and the prongs must be insulated from each other and each connected with its respective insulated wire which leads to the discharging points. To use the apparatus in this form the box has to be rotated. This can be done by a motion of the hand directly on the box or by any of the well-known mechanical devices for producing circular motion. Or only one pivot may be insulated from the box in the manner described and the other electrically connected with the tube, when one conducting wire from the insulated axis to the top will be sufficient, the tube itself forming the other conductor or pole.

1298. "Apparatus for carrying, protecting and insulating wires employed for conveying electric currents." R. LONGDON and F. B. WELCH. Dated March 12. 6d. Relates to improved means for carrying, protecting and insulating wires used for conveying electric currents, such as are employed for electric lighting, electric telegraphs, telephones and other similar purposes, so as to insure perfect insulation, safety from fire and protection from injury from accidental or other contact therewith. For this purpose the inventors propose, according to the invention, to employ longitudinal slabs of slate of convenient length and of a suitable width, according to the number of wires to be conveyed, in the upper surface of which they cut or form (preferably by means of a planing machine) a series of parallel longitudinal grooves. They lay one wire in each groove and cover the same over with a solid slab or cover of slate fixed on by means of screws or otherwise, or with a sheet of brown paper or asbestos paper or other suitable material cemented on. Or they form the grooved slabs with raised edges and hold the wires down at intervals by means of cross-bridge pieces of slate or other suitable material fixed in a transverse dovetailed groove made in the raised edges.

1314. "Dynamo and magneto-electric machines." C. W. VINCENT. Dated March 12. 6d. Relates, firstly, to means for obtaining the rapid magnetisation and demagnetisation of the iron cores of armatures in dynamo and magneto-electric machines; and, secondly, to means for obtaining magnetic fields of great strength with a diminution in the weight of the wire employed. In order to obtain the first-named result, the inventor uses, in place of a solid core for the armature, a packing of iron or steel filings, or it may be scrap iron or borings, making the same compact in the armature drum or other foundation by the application of pressure. This disintegrated or loose metallic filling greatly facilitates the molecular action induced by the exterior field-magnets. In order to obtain a more active magnetic field than heretofore, it is proposed, in lieu of using insulated copper wire, to wind insulated iron or steel wire on the field-magnets. The increased resistance which this metal affords, the inventor utilises as a creative force, as it affords him a magnet in each convolution of the helix, or rather a series of magnets (in each convolution) arranged with their poles at opposite sides of the wire, having their north poles to the left hand of the course of the current.

1364. "Dynamo-electric and electro-dynamic machines, &c." C. W. SIEMENS. Dated March 14. 2d. The inventor employs a coiled armature of any known construction, having a non-magnetic core, and he surrounds this by a stationary coil of wire arranged as a meridian to the armature, that is to say, in a plane passing through the axis of revolution. (*Provisional only.*)

1370. "Mechanism of electric meters, &c." P. JOLIN, J. PARSONS, and M. F. PURCELL. Dated March 14. 4d. Consists chiefly of an electro-magnet coiled with wire in various ways and employed to actuate the winding mechanism of the clockwork, which, by means of the counter aforesaid, measures, indicates and registers the amount of current passing.

1371. "Commutators for dynamo-electric machines." S. Z. DE FERRANTI and V. S. SZEZEPANOWSKI. Dated March 14. 8d. Has for its object improvements in commutators for dynamo-electric machines, and relates mainly to dynamo machines, in which the armature is composed of a zig-zag conducting coil the radial portions of which are carried past the poles of fixed stationary magnets placed on either side of the coil.

1403. "Telephonic apparatus, &c." W. MOSELEY. Dated March 16. 8d. The main object of this invention is to provide for transmitting the human voice, by means of apparatus that will effect all the objects desired with greater economy and in less time than is practicable with any existing apparatus or system, and at the same time will be less liable to wear and tear and accident than any heretofore used.

1430. "Galvanic batteries." J. B. HANNAY. Dated March 19. 4d. Has for its object the construction of galvanic batteries of

large size in a simple and economical manner, and comprises the use of an exciting liquid capable of yielding a moderate current for a considerable period without great variation of strength. For the cells or vessels of the improved batteries wooden barrels are used, each of about the size to contain from 30 to 40 gallons of liquid. Each barrel has its inner surface coated with paraffine, and there is placed on the bottom of it a board fitted with a series of vertical pegs, forming a rack for holding the copper and zinc plates, which are arranged alternately between the pegs. In each barrel there is by preference one more copper plate than the number of zinc plates, and the zinc plates and copper plates are by preference respectively joined to the same two conductors so as to give quantity rather than intensity, an arrangement which may however be modified for different purposes. The exciting liquid is a solution of bisulphate of soda, and roughly crushed pumice stone is filled in to prevent excessive motion of the liquid when the battery is being moved from place to place.

1440. "Electric safety lamp." J. IMRAY. (Communicated from abroad by G. Mangin and C. A. Le Royer, of Paris). Dated March 19. 2d. In this invention the lamp is suspended within a strong glass cylinder containing water, which may be made to circulate through the cylinder. The cylinder is held between a top and a bottom plate which are tied together by springs, and the lamp is attached to the top plate by a boss of insulating material containing the conductors to and from the lamp. *(Provisional only).*

1481. "Generating Electricity." J. A. KENDALL. Dated March 21. 4d. Consists in an improved method of employing hydrogen in order to produce a current of electricity. The apparatus employed for the purposes of this invention consists essentially of two metallic plates or layers, between which and in contact with one side of each plate or layer is arranged a fused or strongly heated saline, vitreous or vitrified substance. The opposite side of one of the plates is kept supplied with hydrogen gas or a combustible gas containing free hydrogen, and the opposite side of the second plate is exposed to heated air, or to some material having an effect equivalent to the oxidizing effect of heated air.

2204. "Electric railways." SYDNEY OIT. Dated May 1. (Communicated from abroad by L. Daft, of America.) 6d. Relates to an improved method of operating an electrical railway, and an improved method of regulating the quantity of electricity which is sent out upon the same. Described in ELECTRICAL REVIEW for September 22, 1883.

1882.

6153. "Electric and other lamps." J. M. FLETCHER. Dated December 23. 2d. The object of this invention is to render electric and other lamps (especially that class known as incandescent lamps) more ornamental and useful than heretofore (*Provisional protection not allowed.*)

DISCLAIMER.

3988**. "Electric lighting, &c." (Fox's patent.) Anglo-American Brush Electric Light Corporation's disclaimer and memorandum of alteration. Filed July 30, 1883. 4d.

3134*. (1878.) "Apparatus for the dynamical production and application of electricity." (A communication from abroad by Ernst Werner Siemens and Friedrich Hefner von Alteneck, both of Berlin, bearing date the 8th day of August, 1878, No. 3134.) Siemens' disclaimer and memorandum of alteration. Filed September 11, 1883. 4d.

CORRESPONDENCE.

The Effects of Lightning.

In reply to Colonel Parnell's in your impression of Oct. 22nd, 1883, no doubt the name of A. Parnell, Colonel late Royal Engineers, will have great weight with many, who seek for information on the above subject, and if his misleading statements are allowed to go unchallenged will do a serious amount of harm.

Now, sir, with your kind permission, I should like to pit upwards of 26 years practical experience against his 200 years of theory, so commence by saying that there is no such thing as thunderbolt, but will call it a powerful discharge of electricity; next, that the discharge descends from the clouds, and not from the earth, which only receives it after the discharge, and when a discharge takes place, as a rule, it strikes the nearest object in its downward path to earth.

Now, if the substance so struck should happen to be a good conductor, such as a copper rod, or rope, iron building, water pipe, or any metallical substance, having a good earth connection, in 999 cases out of a 1000, no damage is done to them. On the other hand, should it strike a non or bad conductor, the resistance offered in its passage to earth by the substance so struck is the cause of the damage done to that object. Now, the so-called upward flash is nothing more or less than a part of the downward discharge, which cannot get to earth all at once, owing to that resistance offered, and so strikes upwards, or flashes to the next thing to it, to find a passage to earth.

You will often see a building, tree, or stack, non-protected, struck and damaged, when near by is a stack or building protected by a conductor. Now, the cause of that is the unprotected building happens to be the first to come in contact with the accumulator or thundercloud, showing that the conductor does not attract, except in its near neighbourhood. Now, what a properly fixed conductor will do is this, it facilitates the discharge of the electricity to earth, so as to carry it off harmlessly, and it tends to prevent a destructive discharge by silently neutralizing the conditions which determine such discharge in the near neighbourhood of such conductor.

Now, if proof is wanted as to the course the discharge takes, select a conductor fixed to some high building, such as a stack or church steeple, cut the conductor through, say 10 ft. from the ground, separate the ends about $\frac{3}{4}$ of an inch, then watch which way the flashes cross the breach. You will find that it is from the upper part of the conductor to the lower part, and if the conductor is properly earthed you will find no upward flash take place owing to the absence of resistance.

Now, as to the safest places during a thunderstorm, should the surface or outer walls of the building be struck, the underground kitchen is the safest place, owing to its being lower than the surface level of the earth. Should the chimney, which, as a rule, is the object struck, owing to the carbon nature of the soot, forming a good conductor to the grate or cooking range, it being nearer the earth than the grates of the upper rooms, which are insulated from the earth. It conveys the discharge off with less chance of damage. Now, if you have no underground kitchen, and wish to be comparatively safe, select a room on the ground floor, open all your doors, take a coil of No. 8 copper wire, or good thick iron wire, of sufficient length to reach from the grate into the back yard, make one end fast to the water pipe or lead pump, drop it into the well, or bury it two or three feet in the soil of the garden, and when you perceive a storm coming on uncoil it, and carry it into the room selected, wrap it round the bar of the grate, then push the spare end a short distance up the chimney; next collect the whole of your family into the above room, taking care to place them anywhere but in a line with the draught of the open door and the fireplace. When the storm has passed safely over, coil up your wire and place it by till next required. This applies to buildings not protected by conductors; should they be protected, see that every particle of metal, such as spouts, tie-rods, weather vanes, soft water, cisterns, &c., should be metallically connected to the conductor. Next, a wood building is safer than a brick one, as in a storm it absorbs more moisture, and becomes a better conductor. An iron building is safer than a wooden building if the iron is in connection with the earth. A low building is safer than a high one. Low ground safer than high ground. Soft, sappy, wooded trees, such as elm, safer than oak, as oak is denser in grain, and contains less sap, making it a worse conductor.

The shelter of trees should be avoided, but if necessity compels, select one of the shortest of a group in preference to one isolated, standing as far from the butt as possible for shelter.

Umbrellas are better down than up, for should a discharge strike it, it will in all probability pass through the holder's body to earth. This applies to carrying other metallic substances during a storm. In conclusion I wish to endorse the remarks of Mr. C. W. Farquhar, *re* pit headgear, guide ropes, &c., also Colonel

Parnell's suggestion as to erecting buildings upon farms for the shelter of workpeople, but by all means let them be protected by a lightning conductor. I also think that if the gallant Colonel would make himself better acquainted with the laws of electricity he would alter his views.

G. Thompson.

Telegraphs, Birmingham,
Nov. 7th, 1883.

[We feel sure that whatever may be the views held by Col. Parnell on this subject, our correspondent's letter is not likely to shake them. The style of Mr. Thompson's communication leads us to believe that he is a frequent contributor to the comic journals.—EDS. ELEC. REV.]

The New Patent Law.

Patents which may be granted under this law, seem to me, will be like unto the wares of "Cheap Jack"—almost worthless, and I urge inventors to file their applications for patents before 1st January next, and thereby secure a patent under the present law, which guarantees to the patentee the exclusive right to use, work, or sell his invention for fourteen years.

Under the new law the patentee will not have any such exclusive rights. Section 22 of this *anti-protecting* law reads, "If on the petition of any person interested it is proved to the Board of Trade that, by reason of the default of a patentee to grant licenses on *reasonable terms*, the reasonable requiremenis of the public, with respect to the invention, cannot be supplied, the Board of Trade may order the patentee to grant licenses on such terms, as to the amount of royalties, as the Board, having regard to the nature of the invention and the circumstances of the case may deem just, and any such order may be enforced by mandamus."

This law fails to make provision for an appeal from the decision of the Board of Trade.

Section 46, reads, "*Patentee* means the person for the time being entitled to the benefit of the patent."

In my opinion, these two sections will render valueless, to the inventor, any invention for which letters patent may be issued under this new law.

I submit to inventors a case showing the effects of this law:—

An inventor obtains a patent under this law for a valuable machine, for which he offers to grant an exclusive license in consideration of certain royalties. No one is willing to take the exclusive license, although he considers the terms to be reasonable, because the licensee may be compelled by the Board of Trade to grant sub-licenses, for less royalties, and the patentee fails to find a person to take the exclusive license.

The patentee seeks a purchaser of the letters patent, but will any person or company purchase a patent for which the Board of Trade may, at any time, compel the purchaser to grant licenses for such royalties as to the Board of Trade may seem reasonable?

The patentee can neither find a licensee nor a purchaser, and the invention is not supplied to the public. After several years shall have expired since the issue of the letters patent, perhaps some *person interested* petitions the Board of Trade to compel the patentee to grant him a license on such *reasonable terms as the Board may deem just*, the petitioner alleging that the patent is not of much value, because no licensee nor purchaser has been found for it at any price, and the Board of Trade will no doubt consider a very small royalty to be a reasonable sum.

There is an old saying: "There is no wrong without a remedy," and the only remedy of this wrong which suggests itself to my mind, is for an interested person to petition the Board of Trade to compel the patentee to grant him a license on what he, the licensee, considers reasonable terms—having previously arranged the terms with the patentee, the *reasonable royalty* being thus once established by the Board, all other *interested persons*, who may desire to procure a license will be obliged to pay the same royalty. Such a proceeding may seem to partake of "*collusion*," but no judge could for a moment entertain such an opinion.

I strongly urge those inventors who have any inventions, for which they can prepare provisional specifications, to file them before 1st January next, under the present law, which guarantees to the patentee the exclusive right to his inventions at perhaps a less cost than under the new law, and at infinitely less danger from opposition.

W. C. Barney.

Nov. 12th, 1883.

The Utilisation of the Forces of Nature.

I am pleased to see by your leader in the ELECTRICAL REVIEW of November 10th that you coincide with my plan for utilising the force of the wind by the raising of a weight, and thus storing, with but little loss, an enormous amount of mechanical energy, published, as far as I know, for the first time in your issue of August 11th, 1883, page 112, which plan I hope before long to put into actual practice, and to undertake the erection of wind engines for the above-named purpose.

Your remarks upon lighting by incandescence are only correct when applied to those that supply the current that have to pay an expensive directorate, &c., and high-priced machinery, and only view the case from one standpoint, viz., by comparison with the price of coal gas. What have you to say to the following? A gentleman called on me a few weeks since—he is the proprietor of a large printing establishment, and will have his premises lighted shortly with incandescence lamps—he said: "I know that coal gas is cheap enough, and that I can get plenty of light, and it is easily applied, but the health of my workpeople is suffering from the result of combustion and excessive heat, especially the females, who are employed at the top of the building, and I *must* have a light that is more pure—that does not poison the atmosphere." He added: "the cost may be more, but I must have it."

This is a proof to my long-held argument that *necessity* was calling into existence the use of electric illumination over coal gas, in the same sense that necessity called into use coal gas over oil lamps and candles. It must not be forgotten that coal gas had its opponents; notably among them was Sir Humphry Davy, also Sir Walter Scott, who said: "When Edinburgh becomes partly lighted with coal gas I will eat my hat." Well, he never lived to eat his hat, but he did live to become a member of the board of direction of the Edinburgh Gas Light Company.

Notwithstanding what has been said to the contrary, we may suddenly find that our coal supply is running short, and we may be driven by necessity to utilise the power of the wind and tide, but before that time comes we ought to commence to utilise the natural forces so abundantly at command. I hold that the cost of incandescence lighting is not in the least proved by asserting what such and such a company can supply it for to pay *them*.

A. J. Jarman.

London,
August 10th, 1883.

Re "Alternate Electric Machines."

Dr. Hopkinson has recently shown that two, or even more, alternate machines may be worked on the same circuit in parallel, driven independently of one another. It would be interesting to know how this arrangement works in practice, as, theoretically, the armature of one machine, when on its reversing point, short circuits the external resistance, and this would cause loss by heating the armatures driven in this manner. It would also be interesting to know what percentage of loss this short circuiting would cause.

Information on this point cannot but be valuable just now, and to my mind it will influence the future of alternate current machines.

W. S. H.

Albion Hall, Dalston, E., London,
Nov. 13th, 1883.